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NOTES ON *ANOPHELES OCCIDENTALIS* D & K AND *ANOPHELES QUADRIMACULATUS* SAY.

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Anopheles occidentalis D & K was reported during the season of 1942 as occurring in numbers at Cayuta Lake, N. Y., at an elevation of 1,272 feet.[1] Considerable numbers of this species were observed late in the season of 1942 (Nov. 7) and were probably preparing for hibernation. At the same time, *A. quadrimaculatus* Say was collected and they were also preparing for hibernation. In the spring of 1943 (May 5) considerable numbers of *A. occidentalis* were collected along with a few of *A. quadrimaculatus*. During the summer a few trips were made to Cayuta Lake but adults were scarce and on July 16 I could find neither larvae nor adults. During the summer of 1942 a diligent search was made for the breeding habitats of these anophelines. The swamp, margins of the lake and the stream outlet, was searched in vain but only a few larvae were taken. In the spring of 1944 (May 1) the adults of *A. occidentalis* were present in considerable numbers and actively biting. A few *A. quadrimaculatus* were also present and biting. From May 1 to May 3 some 50 *A. occidentalis* were taken and sent to Dr. Boyd at Tallahassee, Florida. Dr. Boyd attempted to colonize them but he only obtained a colony, a flourishing one, of *A. quadrimaculatus*. Evidently a few *A. quadrimaculatus* were included in the shipment. All of the *A. occidentalis* refused to lay eggs and died. Dr. Boyd returned some of the reared material and they all proved to be *A. quadrimaculatus*. He also included some of the adults I sent him and amongst them were a few *A. occidentalis*. Early in June I sent a shipment of *A. occidentalis* to Dr. R. B. Watson at Memphis, Tenn., with the hope that he might be able to establish a colony. His results were very similar to Dr. Boyd's, though he did succeed in obtaining a few eggs and rearing a few adults. He was not successful in establishing a colony.

During the summer of 1944 the sudden appearance of *A. quadrimaculatus* in immense numbers at Cayuta Lake was the remarkable feature of the season. At the same time *A. occidentalis* occurred only in very scattered numbers, though in 1942 it was the dominant species and in the spring of 1943 (May) it was present in considerable numbers. During the season of 1943 neither *A. occidentalis* or *quadrimaculatus* occurred in any considerable numbers.

Early in June, 1944, the adult females of *A. occidentalis* appeared in sufficient numbers to warrant the belief that there would be great swarms of them later in the season. At the same time *A. quadrimaculatus* were more abundant than they had been observed at any time since we found anopheline breeding in this area. On August 4 both species were present but *A. quadrimaculatus* outnumbered *occidentalis* by thousands. In the outlet from Cayuta Lake (Fig. 1) the larvae were abundant and on August 11 single dips would give us 20 or more larvae. The larvae were in all stages of development. Under the slip in the boat house the males of *quadrimaculatus* congregated in immense numbers, all apparently freshly emerged. At a nearby home males and females of this species were present in such numbers that the walls near the entrance door were almost black with them, the males greatly outnumbering the females. At this time very few adults of *occidentalis* could be found.

Large numbers of larvae were taken on August 11 with the hope that we should find enough larvae of *occidentalis* to start a colony. All the larvae, several hundreds, were examined and those having branched inner clypeals were isolated. From this

[1] Matheson, R. and Belkin, J. N. Proc. 30th Ann. Mtg. N. J. Mosq. Exterm. Assoc., pp. 7-10. 1943.

number only sixteen with branched clypeals were found. From these sixteen 6 *A. occidentalis* and 10 *A. quadrimaculatus* were reared. Hundreds of *quadrimaculatus* emerged from the remaining larvae but no *occidentalis*. All the larval skins of the 16 reared were mounted and studied to determine if characters could be found to separate these two species. A summary of the results is given below.

No.	Species	Inner Clypeals branches of: Right	Left	Distance between clypeals (inner)
1.	*occidentalis*	2	2	Tubercle can be barely placed between clypeals
2.	"	2	2	"
3.	"	2	2	"
4.	"	2	2	Tubercle cannot be placed
5.	"	3	2	"
6.	"	2	2	"
7.	*quadrimaculaus*	1	2	Clypeals widely spaced more than 1 tubercle can be placed
8.	"	1	2	
9.	"	2	2	"
10.	"	1	3	"
11.	"	1	2	"
12.	"	3	1	"
13.	"	2	1	"
14.	"	2	1	"
15.	"	1	2	Very widely placed
16.	"	3	2	Clypeals widely spaced

A study of the chaetotaxy of the larva reveals other differences that will aid in separating *occidentalis* from *quadrimaculatus*. The arrangement of the hairs of abdominal segments 4 and 5 correspond rather closely. Hair "O" is present in both and very minute and unbranched. In *quadrimaculatus* hair "2" is stout and unbranched, though occasionally it may be branched near the tip (8 reared specimens examined and only one had this hair branched near the tip). In *occidentalis* hair "2" is quite long, rather slender and with 4 or 5 branches arising from near the middle (7 reared larvae examined). As we cannot depend on the branching of the inner clypeals to differentiate these two species in the larval stages we must make our determination on a combination of these characters. The branched inner clypeals spaced close together at their bases and the 4 or 5 branched No. 2 hair of segment 4 of the abdomen should differentiate *occidentalis;* the usually unbranched inner clypeals spaced far apart at their bases and the stout unbranched No. 2 hair of segment 4 should identify *quadrimaculatus*. However, these combinations of characters may not always be reliable and rearing should be done whenever possible.

During the season of 1944 *A. quadrimaculatus* was the dominant species whereas in 1942 *A. occidentalis* was very abundant and very few *quadrimaculatus* could be found. The following records will show the relation between the two species. On August 18, 26 and September 9, *quadrimaculatus* was extremely abundant, the males and females congregating in great numbers on nearby houses. Practically no *occidentalis* could be located, just an occasional single specimen. This was also true on October 4 when I made a collection in an old outdoor toilet not far from the lake margin. This collection amounted to several hundred adults. In this collection I found only 2 *occidentalis* (females) and 2 females of *punctipennis;* all the rest were *quadrimaculatus*. On October 12 similar conditions were found, all were *quadrimaculatus* and not a single specimen of either of the other species. On October 28 five females of *quadrimaculatus* were found in the same toilet but none of the other species were present.

Why did *A. quadrimaculatus* supplant *A. occidentalis* during the season of 1944? In 1942 we had severe floods during the early half of August and the lake remained high during most of the season. In 1944 there was little rain and the lake and its outlet were very low. As a result the water lillies (*Nymphaea*) occurred in abundance

Fig. 1. Outlet of Cayuta Lake, N. Y. Note the yellow water lily in the background. In the foreground and center the water milfoil *(Myriophyllum)* breaks the surface and here the larvae occur in great numbers. (Aug. 1944).

in the outlet and the shallower parts of the lake; also the species of water milfoil (*Myriophyllum*) grew in abundance and their tips floated in masses on the water surface (Fig. 1). About the floating leaves of the water lilies and in the mats of water milfoil the larvae of *quadrimaculatus* were present in great numbers. Dipping made in the mats of water milfoil often yielded 20 or more larvae per dip and most of the larvae were those of *quadrimaculatus*. Such conditions would seem ideal also for *occidentalis;* however, this species failed to breed in any numbers.

The only value in these few observations is the important fact that a malaria transmitting anopheline, *A. quadrimaculatus,* could be considered on the basis of our observations of 1942 and 1943 very unimportant in this isolated region whereas in 1944 the very opposite conclusions would have to be drawn. Similar conditions may occur in many, if not all, parts of our country.

A MECHANICAL TRAP FOR THE SAMPLING OF AERIAL INSECT POPULATIONS[1]

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United States Department of Agriculture

The essential principle involved in the construction of all models of this trap is that power is so applied to one or more rigid insect nets as to cause them to rotate in a fixed horizontal plane at a speed sufficient to capture and concentrate in a removable collecting bag any insects which might be intercepted.

A trap (fig. 1) built upon the plan here presented will efficiently sample aerial insect populations, with the possible exception of certain insects such as swiftly flying Odonata and Diptera. It offers a quantitative method of determining the population density of flying insects at different elevations and at different periods of the diurnal and annual cycles relative to such factors as time, temperature, humidity, and light intensity. Accurate records can be obtained for periods as brief as 5 minutes or less or for as much longer as desired. If the interval between the taking of collections is not too long, the insects caught are generally not seriously damaged and are for the most part in suitable condition for preservation as museum specimens.

This trap works efficiently and independently of the use of attractants or light. For certain insects, however, when maximum catches are desired rather than random samples of populations, lights, baits, or combinations of both can be effectively used as adjuncts.

An excellent illustration of the type of data which can be obtained with this machine is contained in a paper by Barnes, Fisher, and Kaloostian,[2] who used one of the machines built by the present writers.

[1] This is a revision of processed Circular ET-163 published by the Bureau of Entomology and Plant Quarantine in October 1940.

[2] Barnes, Dwight F., Fisher, Charles K., and Kaloostian, George H. Flight Habits of the Raisin Moth and Other Insects as Indicated by the Use of a Rotary Net. Jour. Econ. Ent. 32 (6): 859-863, illus. 1939.

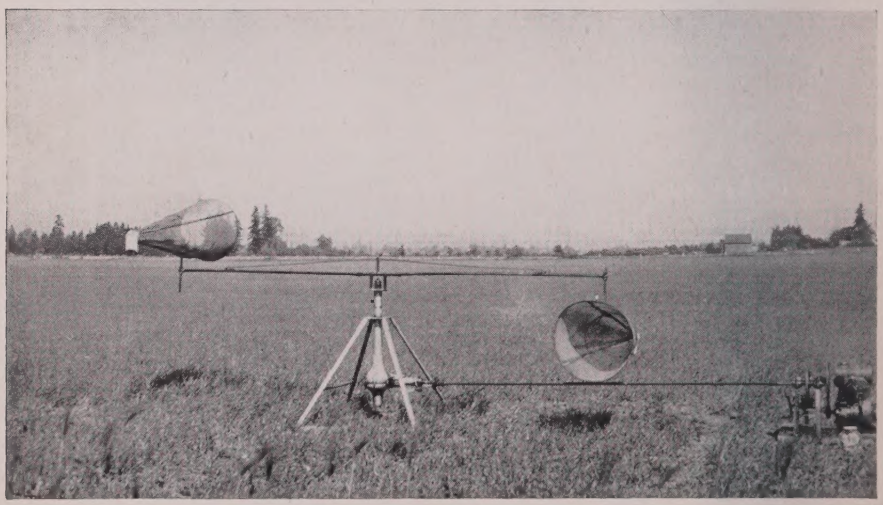

Fig. 1. General view of rotary trap. The entire net assembly may be supported either by a heavy bolted wooden construction or by a pyramidal frame of welded angle iron as shown.

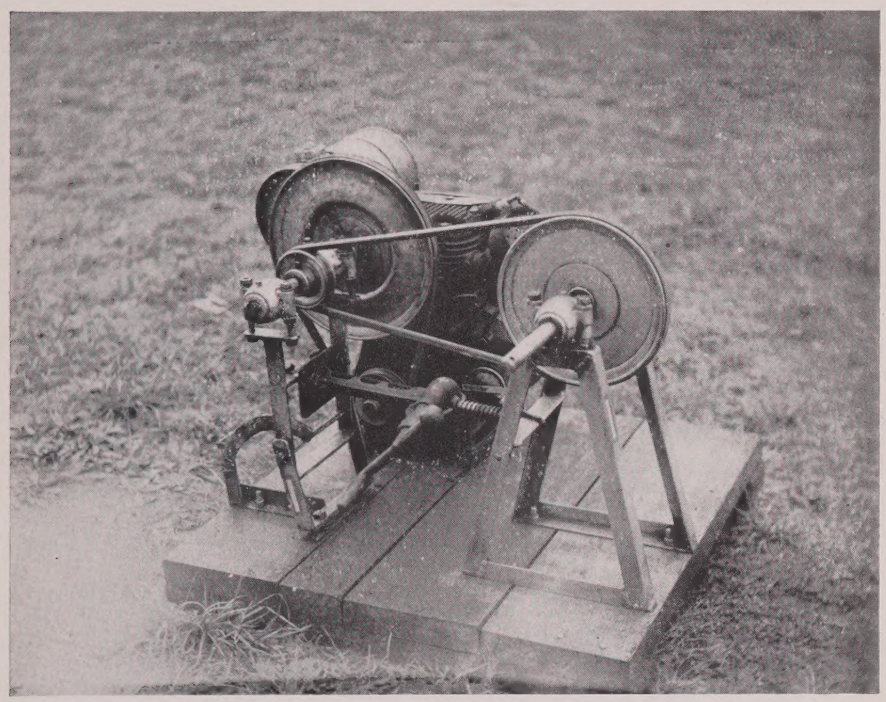

Fig. 2. Motor and clutch assembly. The trap is started or stopped by tightening the belt by means of the specially mounted automobile jack, which tilts the countershaft. The motor is a 1-horsepower, air-cooled gasoline engine.

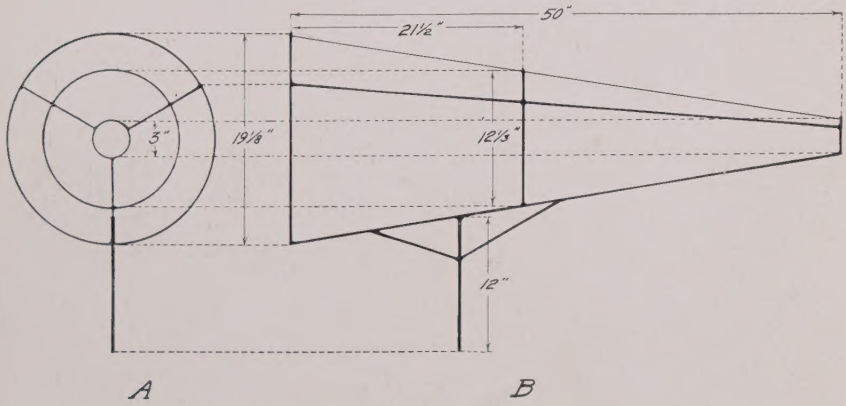

Fig. 3. Diagram showing the dimensions and construction of the collecting net. The framework is of ¼-inch iron rod and welded throughout, except for the 12-inch supporting arm, which is of ½-inch rod or pipe. *A*, Front view; *B*, side view. The net covering (not shown) is of 16-mesh screen wire with all seams soldered.

Each net of this trap (net opening, 2 square feet in area; diameter of circle described by net, 12 feet) will theoretically collect the insects from approximately 248,000 cubic feet of air per hour at a speed of 55 r. p. m.

The cost of the machine, exclusive of the motor, will range from $50 to $70 if built by hired labor. The machine can be built by any good automobile mechanic or machinist.

The net assembly comprises one or more nets, together with supporting radial arms and adjustments. Where only one net is employed, it must be suitably counterbalanced. Each net is mounted at the end of a braced, 6-foot arm, so that in rotation the nets describe a circle 12 feet in diameter.

Since the speed of the motor is much greater than that of the net, and the axis of rotation of the motor is in a horizontal plane while that of the nets is in a vertical plane, it is necessary that there be an intervening set of gears. In the trap illustrated, a cutdown rear axle of a model T Ford car, mounted L fashion on the net support, serves this purpose. Any automobile rear axle should be equally adaptable. One axle is cut off just beyond the differential housing, and a plate is then welded across the casing to make it oil-tight. The hub of one of the wheels of the rear axle assembly is then employed for mounting the net arms, while the universal transmission joint of the drive shaft serves the same purpose in the trap as in the original automobile. Because of the light load, a light crankcase motor oil replaces the usual heavy lubricant in the differential. The whole unit is very durable and weatherproof.

The machine is driven by a transmission shaft extending from the net drive shaft to the motor and clutch assembly, which

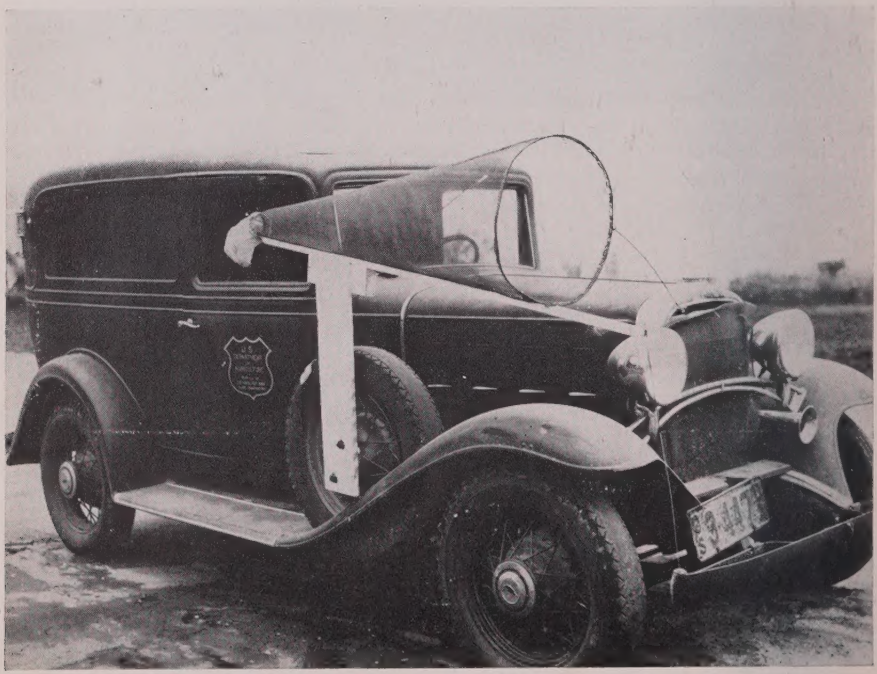

Fig. 5. Collecting net, of the type used on the rotary trap, mounted on an automobile for use in sampling aerial insect populations over extended areas.

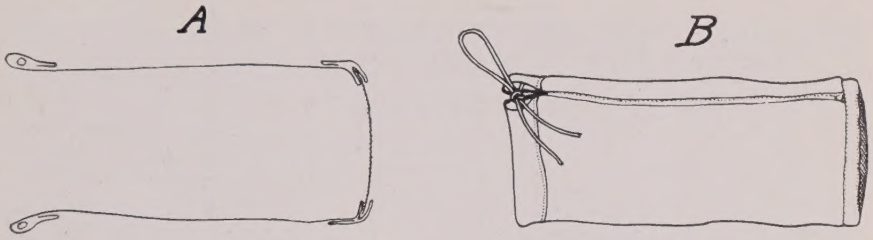

Fig. 4. Diagram showing construction of the collecting bag. The length is 7 inches, the diameter 3¼ inches. The material is muslin, with copper-gauze bottom. *A*, Diagrammatic cross section showing method of sewing in the drawstring and the screen bottom; *B*, the finished bag.

is mounted beyond the sweep of the rotating nets. A flexible connection should be used to connect the motor or drive shaft and the transmission shaft.

The motor and clutch assembly (fig. 2) comprises a small gasoline or electric motor. We have employed ½ to 1-horsepower gasoline motors and ¼ to ½-horsepower electric motors with complete satisfaction. Where electric power is available its use is preferable, since electric motors require less attention and are more reliable than gasoline motors. If a single-phase motor is employed, the use of a clutch is unnecessary, as the trap can be started and stopped by turning a switch. With split-phase motors the clutch must be used to avoid throwing too heavy a starting load on the motor. One net is about the maximum load for a ¼-horsepower motor. We have used a ⅓-horsepower motor to pull two nets. The power required depends somewhat upon the efficiency of the gears employed.

If the automobile transmission is used, one or more reduction pulleys or gears between the motor and clutch are necessary in order to achieve the required net speed. The exact nature and size of these reduction pulleys or gears will vary with the normal motor speed and the desired speed of rotation. Where belt transmission is used, slippage must be allowed for if a particular net speed is desired.

The details of the net construction are shown in figure 3. The framework of the net if of ¼-inch iron rod and is welded throughout. The net proper is of 16-mesh wire screen.

Two types of collecting bags have been used. One is shown in detail in figure 4. The fine copper-gauze bottom prevents serious injury or destruction of the trapped insects. If all-cloth (muslin or similar material) bags are employed, the use of a small wire frame to keep the bag permanently distended minimizes injury to the trapped insects. If such a frame is not used, strong eddies in combination with a marked whipping of the bag badly damage the insects caught.

At the end of each collecting period the small collecting bags are removed and immediately replaced by new bags. The insects collected in the small bags are killed by dropping the bag into a large-mouth killing jar and are later sorted and counted.

A net speed of 20 to 25 miles per hour is adequate to retain most insects. With 6-foot net arms, such as were used in the traps illustrated, a net speed of 55 r. p. m. is equivalent to 23 to 24 miles per hour.

If it is desirable to sample insect aerial populations over an extended area rather than in one spot, a net like the ones used on the rotary traps can be mounted on an automobile. When the car is in motion, insects are collected in exactly the same manner as by the rotary trap. Such a mount is shown in figure 5. It is important that the net be mounted at least 1 foot away from the fender or hood of the car to avoid strong eddies which tend to force insects through the mesh of the screen. The writers have used car speeds up to 45 miles per hour. This apparatus has proved useful under certain circumstances and can be built cheaply.

ABUNDANCE AND FLIGHT HABITS OF CERTAIN ALASKAN MOSQUITOES, AS DETERMINED BY MEANS OF A ROTARY-TYPE TRAP

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United States Department of Agriculture

A rotary-type trap (fig. 1), described elsewhere in this issue (Chamberlin, J. C., and Lawson, F. R., A mechanical trap for the sampling of aerial insect populations, page 4.) was operated almost nightly from late April until mid-September 1944 by the junior author on the grounds of the Alaska Agricultural Experiment Station at Palmer, in the northern Matanuska Valley. Although this trap was operated primarily for the purpose of collecting data on the presence and habits of night-flying cutworm moths, a quantity of other insect material was obtained and examined by him. These collections invariably included a goodly number of mosquitoes, which were segregated according to date and time of capture. By this means a sequence of

Table 1—Prevalence of Mosquito Species in Matanuska, Alaska, During 1944 As Determined from Collections in a Rotary Trap

Period		*Culiseta*					*Aedes* spp.[1]	*Culex apicalis* Adams	*Anopheles maculipennis occidentalis* D. and K.
		impatiens (Walk.)	*incidens* (Thoms.)	*alaskaensis* (Ludl.)	*morsitans* (Theob.)	Damaged			
Apr.	27-30	1	....	125	....	11	.....	....	....
May	1- 5	4	....	35	....	7	.....	....	....
	6-10	9	....	30	....	6	.....	5	....
	11-15	20	0	76	....	17	.....	1	1
	16-20	4	1	13	2	8	0	0	0
	21-25	9	1	16	0	14	97	2	1
	26-30	3	17	13	0	21	85	1	0
June	1- 5	36	2	10	0	13	635	2	2
	6-10	3	1	9	0	9	977	3	1
	11-15	4	0	21	0	10	1072	1	0
	16-20	2	3	7	0	11	404	14	0
	21-25	1	1	3	0	6	307	2	1
	26-30	3	2	0	1	16	467	0	0
July	1- 5	2	1	3	0	11	473	4	0
	6-10	4	4	5	0	17	378	1	1
	11-15	1	1	4	0	7	298	0	1
	16-20	3	2	5	1	8	465	1	0
	21-25	1	1	6	0	10	261	2	0
	26-30	1	0	5	2	7	240	0	1
Aug.	1- 5	2	....	7	0	11	306	1	0
	6-10	5	....	17	6	23	133	2	0
	11-15	6	....	49	11	20	92	1	0
	16-20	4	....	31	9	18	42	3	0
	21-25	31	....	103	20	7	30	2	0
	26-30	36	....	132	8	20	11	0	0
Sept.	1- 5	29	....	147	0	8	10	0	0
	6-14	No collections							
	15-16	9	....	23	0	0	1	0	0

[1] Because of the difficulty in separating *Aedes* of the *stimulans* group, and because many of the specimens were damaged in transit, all specimens of this genus were counted together. Besides *Aedes* of this group, *A. cinereus* Meig. and *A. pullatus* (Coq.) were present but not in large numbers.

Fig. 1. The authors examine a catch of insects in a rotary-type trap in Matanuka Valley, Alaska.

species and their relative abundance at different times in the season and under varying light intensity were obtained throughout the season. All species determinations were made by Alan Stone, of the Division of Insect Identification. The species and numbers caught are given in table 1.

The rotary-type trap has several advantages over the New Jersey light trap. During the mosquito season in the latitude of Alaska there are few hours of darkness when a light trap would effectively attract mosquitoes. Moreover, the rotary trap catches all flying mosquitoes that happen within its collecting range, and by this means one can sample an exact number of cubic feet of atmosphere. Since the trap may be operated by a small gasoline engine as well as by an electric motor, it can be used in remote places where electricity is not available. The trap as used in the Matanuska Valley captured numbers of several species of mosquitoes, although it was located several hundred feet from mosquito-breeding grounds and was operated without an attractant.

One serious disadvantage of this type of trap is that it may injure the specimens captured when unattended for long periods of time.

A trap equipped with two nets, as shown in fig. 1, and operated at 55 r.p.m. removes the insects from approximately 500,000 cubic feet of air per hour. By mounting one of the cones of this trap on the fender of an automobile, one can take continuous samples of mosquito populations while traveling at dusk. With a cone mounted on the right front fender of an army command car, we drove from the Matanuska Valley to Fairbanks, a distance of about

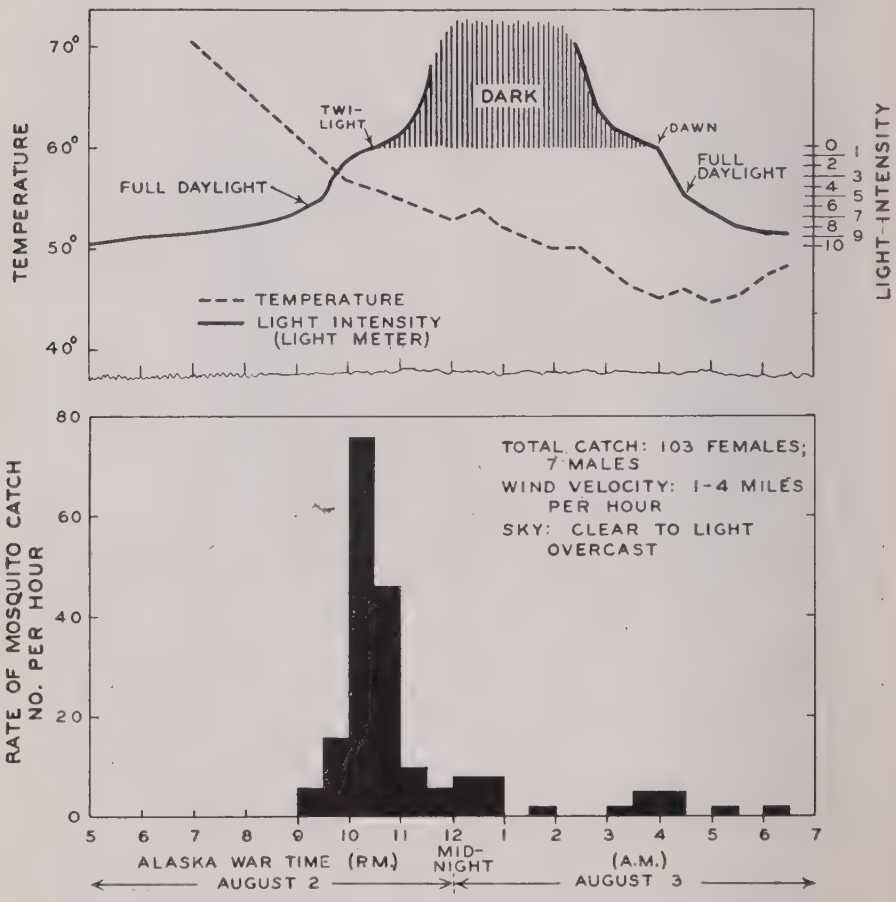

Fig. 2. Rotary trap collection at Matanuska, Alaska, Aug. 2-3,, 1944.

400 miles. About every 25 miles we inspected the catching bag and recorded the numbers of mosquitoes and certain climatic conditions. In this manner we collected a host of flying insects, a few of which were mosquitoes. Table 2 gives the results of these catches compared with 5-minute catches on one of our persons.

Table 2—Mosquitoes Caught in a Cone Trap Mounted on An Automobile Compared With Numbers Caught in 5 Minutes' Collecting by Hand, Palmer to Fairbanks, Alaska, 1944.

Alaska War Time	Temperature, °F.		Miles traveled	No. of Mosquitoes Caught: By trap on car	No. of Mosquitoes Caught: In 5 min. by hand
Palmer to Paxson, July 23					
11:45 a.m.	68°	Sunny	25	0	0
12:35 p.m.	70°	Sunny	49	0	16
2:40 p.m.	74°	Sunny	85	0	0
4:30 p.m.	70°	Sunny	111	0	18
5:15 p.m.	66°	Sunny	136	0	8
6:30 p.m.	69°	Sunny	161	3	3
7:45 p.m.	60°	Cloudy	186	1	3
9:00 p.m.	54°	Light rain	211	11	12
10:15 p.m.	52°	Light rain	236	14	11
Paxson to Fairbanks, July 24					
10:00 a.m.	52°	Light rain	261	1	8
11:15 a.m.	51°	Light rain	286	3	16
1:00 p.m.	58°	Cloudy	311	1	4
2:00 p.m.	70°	Sunny	336	0	17
3:30 p.m.	76°	Sunny	361	0	23
4:45 p.m.	76°	Sunny	386	0	16
5:30 p.m.	77°	Sunny	411	0	3

It is to be particularly noted that mosquitoes were caught in the automobile trap only toward evening and in the morning. The following species were taken in these collections: *Aedes* spp. of the *stimulans* group; *Aedes cinereus, A. pullatus, Culiseta incidens,* and *Culex apicalis.* A few males were taken in the car trap; none of course were captured in the 5-minute collections.

The trap on the car was also used on two consecutive nights on what is known as the Farm Loop Road between Fairbanks and the University of Alaska. Table 3 summarizes these data.

Table 3—Mosquitoes Caught by Means of a Cone Trap Mounted on the Fender of an Automobile While Traveling Along Farm Loop Road, Fairbanks, Alaska, 1944.

Alaska War Time	Light conditions (no wind)	Temperature, °F.	Miles traveled	No. of mosquitoes
July 25-26				
11:00 p.m.	Dusk, cloudy	56°	10	22
12:00 m.	Dusk, cloudy	53°	11	46
1:00 a.m.	Lighter Cloudy	53°	12	22
2:00 a.m.	Early dawn, cloudy	54°	10	21
2:30 a.m.	Daylight, cloudy	54°	11	19
July 26-27				
10:00 p.m.	Sunset, clear	44°±	10	1
10:30 p.m.	Early twilight, clear	44°±	12	0
11:15 p.m.	Dusk, clear	44°±	11	0
12:00 m.	Dusk, clear	44°±	10	4
1:00 a.m.	Dark, clear	44°±	11	2

Since the front opening of the cone trap measured exactly 2 square feet and since the exact mileage was known, each 10-mile trip screened about 105,600 cubic feet of air.

The mosquitoes collected on the Farm Loop Road were *Aedes* species of the *stimulans* group, *Culex apicalis, Culiseta impatiens,* and rarely *Anopheles maculipennis* var, *occidentalis* D and K. Although these collections were made somewhat late in the mosquito season ,a few *Aedes* males were taken. Males of the other species were fairly numerous.

From the data presented in tables 2 and 3 it will be seen that, provided climatic conditions and light intensity are suitable, the cone trap when mounted on the fender of an automobile will catch representative samples of the mosquito population. Furthermore, this method lends itself well to

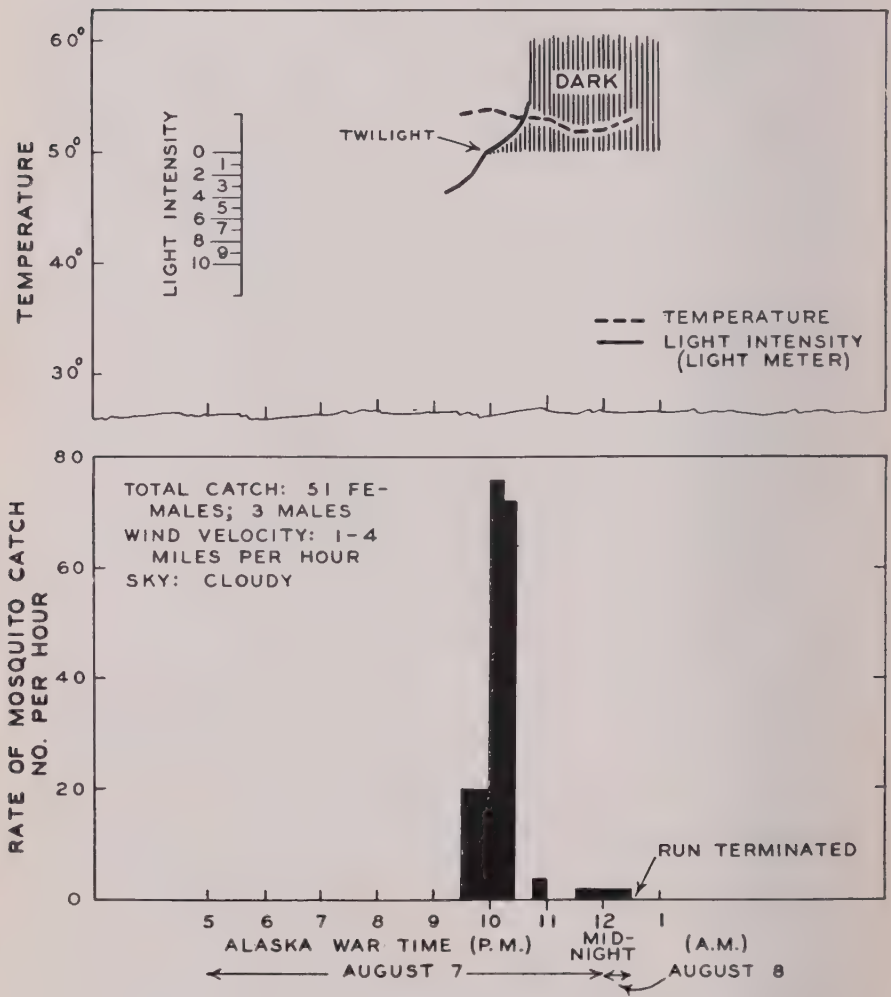

Fig. 3. Rotary trap collection at Matanuska, Alaska, Aug. 7-8, 1944.

gathering species data hastily, if one is reconciled to securing his data from early dusk to total darkness.

Late July, when these data were recorded, is well past the peak of the mosquito season. A much greater number of individuals, although not of species, would probably have been taken at the height of the season, some 30 days earlier. For a complete list of the mosquito species occurring in Alaska the reader is referred to table 4.

During August a special effort was made to determine, for a representative series of dates, something of the flight activity of the general mosquito population relative to various factors, particularly temperature, light, precipitation, wind velocity, and time. Collections were removed at more or less definite intervals, and the total mosquito catch for the various periods was recorded coincident with observations on the meteorological conditions.

These data are shown in graphic form in figures 2-6. The diurnal catches consisted largely of *Aedes* females, with occasional *Aedes* males and *Culiseta alaskaensis, C. morsitans,* and *C. impatiens,* males or females. As far as could be noted at the time from superficial observation, there were no marked differences in the flight behavior of the species caught (for example, the flight of *Aedes* spp. as compared to that of *Culiseta* spp.).

Examination of these charts clearly shows that the mosquito flight at Matanuska, where it was not affected or influenced by the presence of prey, light, or other attractant, was a true crepuscular phenomenon, the peak of flight occurring only during twilight periods. Very few mosquitoes were taken during hours of full daylight or complete darkness, either during these special observations or at any other time during the season.

The diurnal flight pattern of mosquitoes in the Matanuska Valley may be generalized by the following statements: Flight is at a minimum during the hours of full daylight but increases greatly with the coming of twilight. Flight activity starts rather gradually about sunset, and reaches

Table 4—Alaskan Mosquito Records, As Obtained *by Various Collectors*

Species	Alaska in general[1]	Fairbanks 1931[2]	Fairbanks 1944[3]	Matanuska 1944[4]
Anopheles maculipennis occidentalis D and K	105*	x	x	x
Culex apicalis Adams[5]	14	x	x	x
Culiseta				
alaskaensis (Ludl.)	26*	x	..	x
incidens (Thoms.)	27*	..	..	x
impatiens (Walk.)	28*	x	x	x
morsitans (Theob.) syn. *dyari* Coq.	25	..	..	x
Aedes				
pullatus (Coq.)	53*	..	..	x!
diantaeus H. D. and K.	54	x	..	..
punctodes Dyar	55*	!	..	!
punctor (Kby.)	56	X	x	x[7]
leuconotips Dyar	57*	x	..	..
cyclocerculus Dyar	58*	x	..	..
aboriginis Dyar	58*	x	..	..
aldrichi Dyar	63	X	..	..
impiger (Walk.)	63*	x	..	..
cataphylla Dyar	64*	x	..	..
communis (Deg.), *syn. communis* Felt *lazarensis* Young	65*	X	x	x[7]
pionips Dyar	68*	..	..	..
prolixus Dyar	69*	..	..	.. !
campestris D. and K.	70*	..	..	..
exertians (Walk.)	72*	..	x	x
flavescens (Müll.)	74*	..	..	!
stimulans (Walk.), syn. *mercurator* Dyar	75*,76	X	x[6]	x[6]
fitchii (Felt and Young)	78	x	..	..
palustris Dyar	80*	..	..	..
alpinus (L.)	84*	..	..	..
nearcticus Dyar	84*	.	..	..
cinereus Meig.	93	..	..	..

* Alaskan records are positively indicated.

[1] Dyar, H. G. Mosquitoes of the United States. U. S. Natl. Mus. Proc. 62, art. 1, 119 pp. 1923. Numbers refer to pages in the reference.

[2] Tulloch, G. S. Mosquito investigations in Alaska. Psyche 41: 201-210, illus. 1934. The four commonest species are indicated by large crosses. An exclamation mark (!) indicates a Fairbanks record in Dyar's report (*loc. cit.*).

[3] Collections in 1944 by Stage and Chamberlin.

[4] Collections in 1944 by Stage and Chamberlin. An exclamation point (!) indicates a positive specific record for Anchorage, Alaska, by Dyar (*loc. cit.*).

[5] Listed as a synonym of *Culex testaceaus* Van der Wulp in Dyar (*loc. cit.*).

[6] Indeterminte identification; of *stimulans* group.

[7] Indeterminate identification; of *communis-punctor* type.

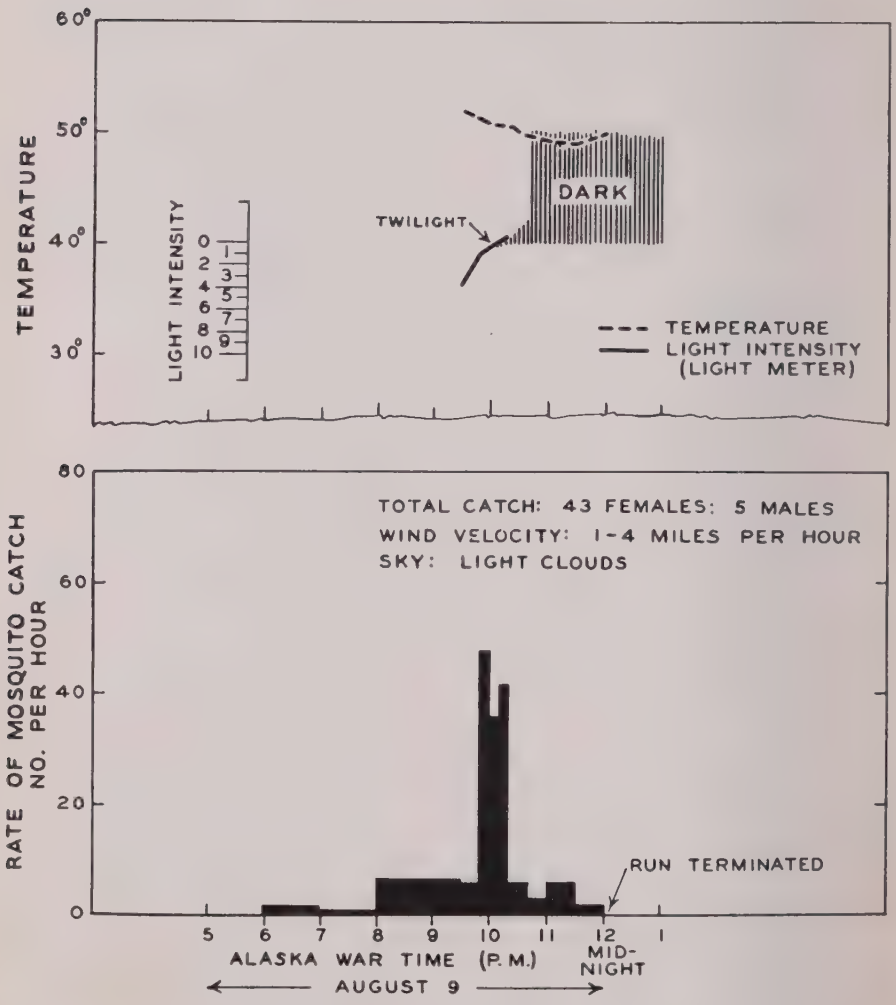

Fig. 4. Rotary trap collection at Matanuska, Alaska, Aug. 9, 1944.

a peak just before complete darkness, and then decreases to a very low rate, if it continues at all, during periods of maximum darkness. Dawn brings another increase in flight activity whicih reaches a maximum well before full daylight, and then again decreases, generally to the vanishing point.

The dawn flight is always of lower magnitude than the evening flight. This is almost certainly the result of less than optimum flight temperatures, which tend to reduce flight activity in spite of favorable light conditions.

The bimodal character of the flight is indicated in figure 2, and to a greater degree in figure 6.

It is of interest to note that light rain during periods otherwise favorable does not markedly inhibit flights (figs. 5 and 6).

The air velocity did not vary sufficiently

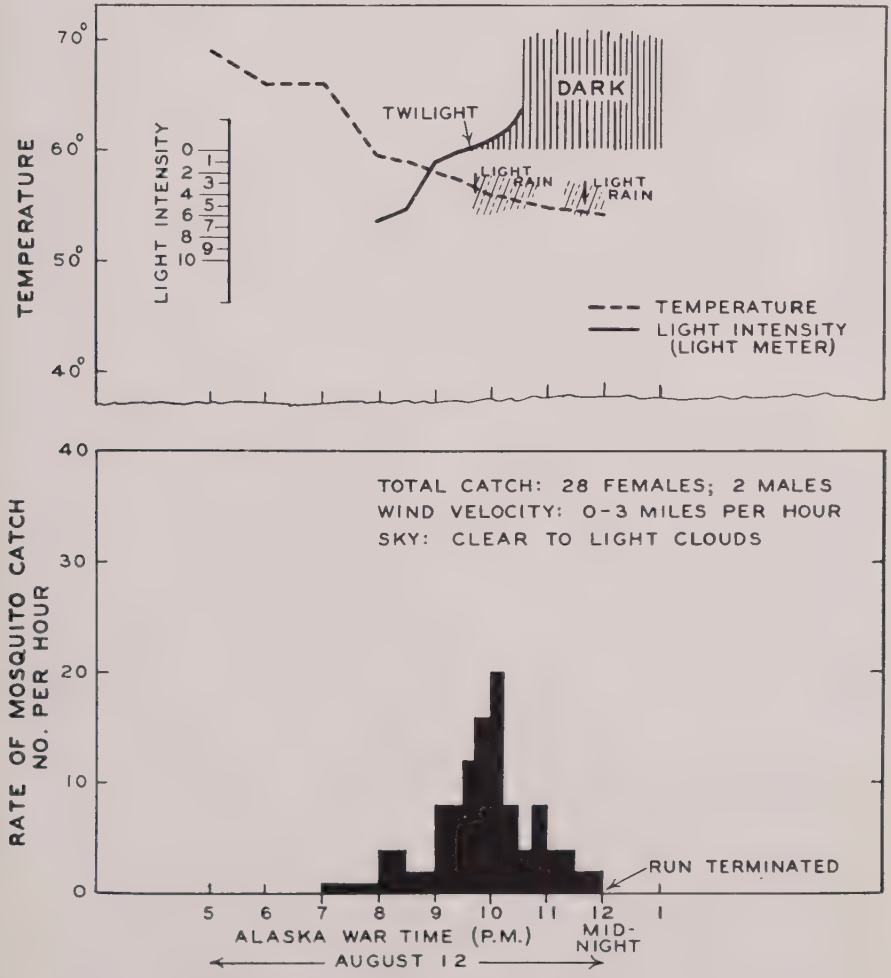

Fig. 5. Rotary trap collection at Matanuska, Alaska, Aug. 12, 1944.

during these tests so that the influence of wind on flight could be ascertained. It is probable, however, that high wind velocities tend to inhibit flight, although they apparently must be in excess of 5 to 6 miles per hour to be effective in this regard.

It should be of considerable interest to obtain similar data for other species and in other localities. This technique should be of value in ascertaining the seasonal sequence of species in particular localities, interspecific associations, and distances of dispersal from breeding grounds. More especially it offers an accurate method of sampling flight activity for very short periods in correlation with any of a large number of physical factors, particularly light intensity and temperature.

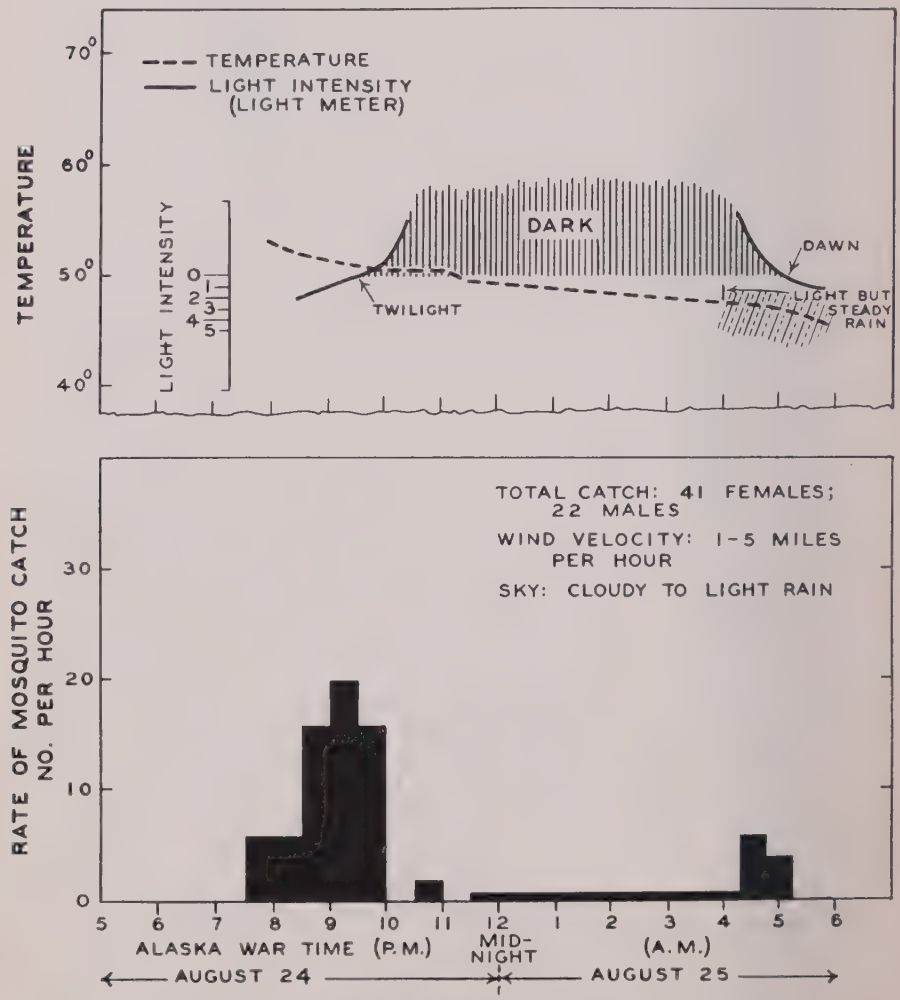

Fig. 6. Rotary trap collection at Matanuska, Alaska, Aug. 24-25, 1944.

A NEW VARIETY OF THE *ANOPHELES PSEUDOPUNCTIPENNIS* COMPLEX IN ECUADOR (DIPTERA: CULICIDAE)

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Following publication of the work of Hackett and Missiroli (1935), evidence has been developed of the existence of distinct varieties within groups of mosquitoes usually considered species. These groups have been termed "complexes"; and several have been studied among the anophelines of America. These include the *maculipennis,* the *tarsimaculatus,* the *crucians* and the *pseudopunctipennis* complexes.

The eggs of *Anopheles pseudopunctipennis* Theobald have been studied by Herms and Freeborn (1920), by Freeborn and Frost (1932, and by Rozeboom (1937). Many studies (see "Literature Cited" below) have been made on the eggs of this complex, and authors have described varieties based on morphological characters of the egg.

The author (1944) has recently described the variety *Anopheles pseudopunctipennis levi-castilloi.* The eggs used in description included 220, deposited by two females in Bucay; all eggs showed the characters used. Larvae and adults reared from some of these eggs were studied carefully. All adults were typical *A. pseudopunctipennis* except that they were smaller in size than the "typicus" variety of Rozeboom.

The egg observed under the microscope in fluid is usually on its side because of the placing of the floats. It is boat-shaped, longer than wide, about 520 microns in length. The floats are easily observed, and occupy the center portion of the egg; each has about 45 to 47 small air-chambers that come radially into a central frill. The floats are about 300 microns in length. Observing the egg from the dorsal position it is divided into two portions by a median line. In the center are the floats attached to a very thin central frill formed of the exochorion. The form of the endochorion gives the rest of the egg a hollow boat-like appearance, the floats being located in the hollow surface formed by the walls of the endochorion. The egg has a light-brownish color, and the floats are white, with margins of air chambers darker. Since this variety had not been before observed, the writer (l. c.) has described it; specimens are deposited with the National Institute of Hygiene in Guayaquil and with the University of Ecuador. The egg is illustrated in Figures 1 and 2.

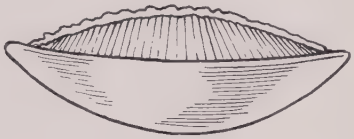

Fig. 1

Fig. 2

Fig. 1. Egg of *Anopheles pseudopunctipennis* var. *levi-castilloi,* side view.

Fig. 2. Egg of *Anopheles psuedopunctipennis* var. *levi-castilloi,* upper surface.

Adults, as stated, are smaller in size than the *typicus* variety; they have more white on the mesonotum, and 4 instead of 6 "leaflets" on the mesosome. The variety is largely confined to the coastal plain of Ecuador, not quite reaching the shore, and extending only a little way into the foothills. It is often associated with *A. albimanus. A. pseudopunctipennis typicus,* on the other hand, occurs in the highlands. It

is interesting to note that *typicus* is a known malaria vector, while *levi-castilloi* has not so far been discovered to transmit malaria.

The *pseudopunctipennis* complex is so widely distributed along the western shores of America, and so variable, that we may probably expect future recognition of several species among its members.

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THE ANAL GILLS OF MOSQUITO LARVAE

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U. S. Public Health Service, Malaria Control in War Areas, Norfolk, Virginia

The length of the anal gills is a useful and usually reliable character for separating salt water mosquito larvae from those of similar but fresh water species. Recently it has been found that in identifying anopheline larvae this character is especially valuable. Larvae of *A. atropos* and *A. bradleyi* which breed in salt water have gills which are much shorter than the anal (ninth visible abdominal) segment, while those of *quadrimaculatus, georgianus, crucians,* and *punctipennis* usually have gills as long or longer than the anal segment. In the last named species the gills are frequently twice the length of that segment. When the length of the anal gills is considered, the task of distinguishing larvae of *A. bradleyi* from those of *punctipennis* and *quadrimaculatus* becomes less perplexing.

The anal gills, which are also known as blood gills, tracheal gills, anal lobes or anal papillae, are of little importance in respiration. Wigglesworth (1939) states that their most important function appears to be the taking up of chloride ions to maintain the normal salt concentration of the haemolymph which is .3 per cent in *Culex*. To illustrate, he points out that larvae of *C. pipiens* which normally breed in fresh water and have long anal gills, will have the gills greatly reduced when reared in water of a relatively high salt content. Conversely, King et al. (1939) have reported that larvae of *Aedes sollicitans* and *A. taeniorhynchus* which normally occur in salt water and have the anal gills short and budlike, will develop long anal gills when reared in fresh water.

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NEWS AND NOTES

FROM SOUTH AMERICA. A letter from Dr. L. W. Hackett, Director for the Rio de la Plata and Andean Regions, The Rockefeller Foundation, International Health Division, Buenos Aires, Argentina, contains the following interesting paragraphs:

"I appreciate your desire for entomological news from this region, and I will be glad to help you to get it; but I have personally abandoned the field of malaria and am engaged in administrative work in general public health . . .

"The Rockefeller Foundation is aiding Bolivia, Peru and Ecuador in mosquito control projects, and perhaps I can get our staff members in those countries to send you a short account of the interesting work they are doing.

"In Bolivia the principal agricultural region is in the foothills of the Andes, and Dr. Henry Carr has accomplished the complete elimination of malaria in a typical area, entirely through the installation of automatic siphons in the streams which are greatly reduced during the dry season. In this area *A. pseudopunctipennis* is the only vector and this species breeds almost entirely in the beds and along the margins of streams.

"In Peru the coastal zone, west of the Andes, is principally desert, crossed by about 50 rivers arising in the snow capped mountains. These river valleys are separated from one another sufficiently to prevent mosquitoes flying from one to the other. This turns each valley into a biological island in which living things, with the exception of birds, cannot leave or enter without the aid of man. We are attempting the total eradication of anopheline species from one of these valleys just south of Lima. Breeding of *A. pseudopunctipennis* takes place from the sea up to an altitude of almost 8000 ft., which covers a stretch of about 50 miles of river. The application of paris green and a certain amount of small open drainage has now reduced our adult anophelines practically to zero, although we found one small larval focus in the lower valley in December. We are optimistic about the possibilities of anopheline eradication in such valleys."

R.D.G.

Anopheles punctimacula Dyar and Knab, CONVICTED AS A VECTOR OF MALARIA. "It is reported by the Departmento de Malariologia of the Servicio Cooperative Inter-americano de Salud Publica in Colombia, that they have succeeded in positively incriminating *Anopheles punctimacula* as a vector of malaria in Medellin. Epidemiological evidence based upon house and Magoon trap catches of Anopheles, reveal that only this species in that locality is appreciably attracted to either burros in traps or humans in their dwellings. Also, a total of six wild-caught infected specimens have been found, only two having been previously reported for the world. This work places upon a much more firm basis the incriminating evidence against this species. The detailed results are to appear probably in Amer. Journ. Trop. Med. in the near future."

Carl B. Huffaker.

FROM SENEGAL, WEST AFRICA. An air-mail letter from T/Sgt. Claude R. Strickland, 29th Medical Composite Unit (Malaria Control), APO 622, c/o P.M., Miami, Florida, (now in Senegal, West Africa) contains the following paragraphs of general interest:

"Relative to insects of this area, I have had the privilege of association with three young fellows who belong to a Malaria Survey Unit. One has made an extensive collection of ticks here, but so far he has not found the *Ornithodorus monbata"* (the carrier of African relapsing fever). "All three are engaged during their spare-time in the collection of a variety of insects. The tsetse fly (probably *Glossina palpalis*) is common here although sleeping sickness is not found this far north. The filaria worm, *Wucheria bancrofti* is common here and was found in abundance in the stomach of *Anopheles funestus* and *A. gambiae*. The disease" (elephantiasis) "is also apparent in local natives.

"Other than malaria control, our unit does little else. Of course, in the routine of native village spraying, we wipe out the flea, bedbug and lice populations. This you may say is purely accidental — they just happen to get in the way of the DDT.

"Certainly, mosquito control and allied fields must be brought together in a common undertaking for public good. Heretofore there have been too many agencies, diversities of opinion and of other factors too numerous to mention that have hindered progress and actually blocked the efforts of all concerned. The public cause of mosquito control can be best served by an integrated organization. I . . . believe the A.M.C.A. will be the norm for such integration."

R.D.G.

NOTES ON MOSQUITOES IN RHODE ISLAND. For the past two years there has been very little work done in Rhode Island toward the actual elimination of mosquito breeding places. Some few towns and cities were induced this spring to make appropriations and clean up their ditches, at least in part, and the City of Providence did a fine job of oiling its sewer basins; but a majority of the towns and cities were indifferent to the February campaign urging them to assume their maintenance obligations.

The reason was labor shortage.

The Division of Entomology and Plant Industry, which in Rhode Island is charged with the ad-

ministration of the state mosquito suppression law, was this year granted $10,000 to carry on its mosquito control activities. Confronted with the same labor shortage as the towns and cities, it employed its energies in making a wriggler survey of fourteen towns in the state and in publicizing measures for the general public to take toward suppressing mosquitoes on private property. Detail plans were drawn up for five post-war projects. The remainder of the appropriation will be spent upon field equipment as it becomes available from the armed forces, and for grants to cooperating towns.

The mosquito survey disclosed some startling facts, especially with regard to the prevalence of anopheline mosquitoes within the state. They were most plentiful adjacent to the Quonset Naval Air Station in North Kingstown, but also were found in small numbers wherever a survey was conducted. The species included *punctipennis, crucians,* and *walkeri,* with *quadrimaculatus* predominent. Several thousand adult *"quads"* were observed last July, clinging to the basement ceiling of an old barn just south of the navy yard fence.

This find aroused considerable concern among ranking officers at the post. Suppressive work on pest mosquitoes within the reservation had been performed earlier by enlisted personnel, following recommendations offered by the state; but these men were not permitted to do control work outside the reservation. Since the state had neither labor nor equipment to undertake it, the U. S. Public Health Service was called to the scene. Acting under easement procured by the state, it dusted with paris green or oiled all anopheline breeding places within a one mile radius of the camp.

Adult mosquitoes discovered in the old barn were found emerging from a weedy, spring-fed pond scarcely 75 by 150 feet in area. Scattered trees overhung the pond, which was located but 800 feet due south of the air station. There was another pond and fresh water swamp one-quarter mile northwest of the air station which likewise supported an amazingly large *"quad"* population.

Other localities where *"quads"* were fairly plentiful this summer include: a pond and cattail swamp covering 40 acres less than three-quarters of a mile southeast of Fort Benjamin Church, Little Compton; a weedy pond and swamp 8 acres in extent on the south side of Slater Memorial Park, Pawtucket; and a medium pond, partly overgrown with weeds, located 300 feet north of Quonochontaug Beach and 1½ miles west of the Naval Air Station in Charlestown. This station is an auxiliary to the Quonset Air Station already mentioned. In Little Compton the *quadrimaculatus* wrigglers were most plentiful along the edge of muskrat channels.

A list of pest mosquitoes found in Rhode Island this summer includes: *C. pipiens, C. salinarius, C. apicalis, C. territans, A. sollicitans, A. vexans, A. aurifer, A. canadensis, A. cantator, M. perturbans, P. ciliata, U. sapphirina, C. morsitans, A. restuans, A. fitchii, C. melanura.*

It is hoped that in the coming year of 1945 both labor and equipment will be available to undertake more work for the control of mosquito breeding in the State of Rhode Island.

William V. Bartosewitz,
State Mosquito Control Supervisor.

MALARIA CONTROL ACTIVITIES IN FLORIDA. A Bureau of Malaria Control was established in the Florida State Board of Health in July 1941. Although the war has curtailed some activities of the Bureau its responsibility in the war effort has greatly increased. In 1942 it was charged with supervising the operation of malaria control in all areas of military importance. In the fall of 1942, at the suggestion of the Surgeon General,s Office, U. S. Army, a school of malariology for the instruction of officers was organized by Dr. John E. Elmendorf, Jr., Director. The school functioned in Florida until January 1944, at which time it was transferred to a foreign post in the tropics.

The Bureau has lost all of its personnel with the exception of John A. Mulrennan, Entomologist, and Nina Branch, Medical Technologist, Dr. John E. Elmendorf, Jr., Director; Dr. Edwin Riley and Dr. R. J. Patterson, Assistant Directors; and James Wright, Engineer, have all entered the military service. Dr. J. Harland Paul, Field Staff member of the Rockefeller Foundation, took over direction in March 1944.

At the present time the Bureau is also engaged in *Aedes aegypti* control and in the formulation of plans to extend efforts to the rural areas of malarious counties in Florida.

J. A. Mulrennan.

FINANCING MALARIA CONTROL WORK IN MEXICO. Mr. J. L. Robertson, Jr., of the U. S. Public Health Service, who has just returned to the States after a two year tour of duty in Mexico, explained the unique way that the Mexican Government has for financing malaria control work. Each letter that is posted with origin and destination in Mexico requires a special stamp in addition to regular postage. The money obtained from this stamp goes to the Mexican Federal Health Department and is spent for permanent malaria control work. The stamp has the figure of a man standing with outstretched arms with a large over-sized mosquito stretched over his back with its probosis imbedded in the man's chest.

R. E. Dorer.

DDT IN PAINT KILLS FLIES. Two British paint chemists, C. G. Campbell and T. F. West, Nature, London, October 21, 1944, p. 512, may have found a means for making the interior of houses deadly to flies and other insect pests (and presumably also for mosquitoes) perhaps for long periods of time. To an oil bound water paint these investigators added 5 per cent of DDT. When panels coated with this paint (and thoroughly dried) were placed in fly cages, the flies were all killed. Two months later the panels coated with DDT-bearing paint were

still effective. In larger scale tests where small rooms were painted with the same material, but where through an error in mixing, the paint contained only one-half of one percent DDT, the painted walls killed 90 percent of the flies that roosted on them over night. Ordinary oil paints and synthetic varnishes, both of which form a more impervious type of surface film, have not given as good results as the flat interior wall paints. If the results of preliminary tests can be uniformly repeated, DDT may become a regular ingredient of interior paints and wall finishes, as a means of automatically suppressing houseflies and mosquitoes indoors. R.D.G.

JOINT MEETING OF THE AMERICAN ASSOC.ATION OF ECONOMIC ENTOMOLOGISTS AND THE ENTOMOLOGICAL SOCIETY OF AMERICA. These two entomological societies held jointly a series of meetings in New York City on December 13-15, 1944, with headquarters at the Hotel New Yorker. Many members of the A.M.C.A. attended these meetings, several who are members also of one or both of the entomological societies concerned presenting very significant papers. Many of the papers read are of interest to all members of the A.M.C.A.

From the standpoint of mosquito control workers, these meetings were especially notable because of the fact that they were made the occasion for releasing the long suppressed results of much experiment work with DDT for control of mosquitoes.

To personalize the report of these meetings, those who read appropriate papers were asked to prepare author's abstracts for publication in MOSQUITO NEWS. These authors' abstracts may be found in the Reviews and Abstracts section.

R.D.G.

THE TWENTY-SEVENTH ANNUAL MEETING OF THE NATIONAL MALARIA SOCIETY. The National Malaria Society held its twenty-seventh annual meeting conjointly with the Southern Medical Association in St. Louis, Mo., from November 14 to 16, 1944. The program was presented in three half-day scientific sessions. That of the 14th, held jointly with the Sanitary Engineers and Sanitation Officers Section, Southern Branch, American Public Health Association, comprised eleven papers. On the 15th a joint session was held with the American Society of Tropical Medicine, at which eleven papers were presented. At the session on the 16th twelve papers were presented. A business meeting was held subsequent to the scientific session on this date at which the following officers were elected for the ensuing year, viz:

Honorary President—Mr. J. A. Le Prince, Memphis, Tennessee.
President—Mr. H. A. Johnson, Memphis, Tennessee.
President-elect—Dr. Mark F. Boyd, Tallahassee, Florida.
Vice-President—Dr. Clay G. Huff, Chicago, Illinois.
Secretary-Treasurer—Dr. Mark F. Boyd, Tallahassee, Florida. M.F.B.

A copy of the program, also, was kindly provided by Dr. Boyd.

All of the papers read at these meetings are of general interest, and several are of outstanding special interest to members of the A.M.C.A., many of whom attended the meetings, and some of whom participated in the program as members also of one or another of the societies concerned.

Some of the papers read at these meetings are:

"Construction and Operation of a 4-inch Hydraulic Dredge" by G. D. Louva and W. A. Legwen.

"A Discussion on Carribean Malaria Control" by J. M. Henderson.

"Malaria Control in a Non-endemic Area" by H. L. Fellton, R. C. Barnes and C. A. Wilson.

"Fluctuation of Anopheline Densities" by G. E. Bradley and R. F. Fritz.

"Tests of the Effectiveness of DDT in Anopheline Control" by S. W. Simmons and Staff.

"Educational Activities as Related to the Problem of Returning Malaria Carriers" by W. S. Boyd.

"Seasonal History of *Anopheles quadrimaculatus* in the Tennessee Valley Region" by R. L. Crowell and A. D. Hess.

"Malaria Control in War Areas," presidential address, by G. H. Bradley.

"Anopheline Surveys in the Fourth Service Command" by S. G. Carpenter.

"Malaria in the Fourth Service Command" by W. A. Summers.

"The Development of DDT for the Control of Larval and Adult *Anopheles* and Other Mosquitoes" by W. E. Knipling.

"The Relation of Plants to Malaria Control on Impounded Waters with a Suggested Classification" by A. D. Hess and T. F. Hall, Jr.

"Water Level Relationships of Plants of Importance to Malaria Control in the Tennessee Valley" by T. F. Hall and A. D. Hess.

"Observations on the Use of DDT for the Control of *Anopheles quadrimaculatus*" by R. L. Metcalf, G. E. Smith, G. M. Jeffery and G. W. Ludwig.

"Material Aspects of Malaria Control in the Fourth Service Command" by S. C. Dews and J. H. Morgan.

"Factors Influencing the Uneven Distribution of *Aedes aegypti* in Texas Cities" by A. C. Chandler. Discussion by R. L. Usinger.

Members of the A. M. C. A. will await with interest publication of the papers read in the course of these meetings. R.D.G.

LSB = Life Sciences Building
AgH = Agriculture Hall

University of California

THE SCHOOL OF PUBLIC HEALTH

SPECIAL TRAINING COURSE IN THE CONTROL OF MOSQUITOES AND MOSQUITO-TRANSMITTED DISEASES

Schedule of Classes — December 4-18, 1944

TIME	FIRST WEEK 4 MONDAY	5 TUESDAY	6 WEDNESDAY	7 THURSDAY	8 FRIDAY	9 SATURDAY
8 10 a m to 9 00 a m						
9 10 a m to 10 00 a m	Registration 3583, 5B	Lecture Parasitism and Parasites 3583 LSB Herms	Lecture Laws Relating to Mosquito Control 3583 LSB Gray	Lecture Laws Relating to Mosquito Control 3583 LSB Gray	Lecture Budgets and Finance 3583 LSB Gray	Laboratory Mosquito Identification 204 AgH Potts
10 10 a m to 11 00 a m			Lecture The Biology of Mosquitoes Freeborn 3583 LSB Herms	Lecture Getting Mosquito Specimens 3583 LSB Reeves	Lecture The Ecology of Mosquitoes 3583 LSB Herms	
11 10 a m to 12 00 noon	Introductory Lecture Dr Brown & Staff 3590 LSB	Lecture Malaria 3583 LSB - Reich		Lecture Yellow Fever and Dengue 3583 LSB Reich		
1 10 a m to 2 00 p m	Lecture Insect Classification 204 AgH Linsley	Lecture History of Insect Transmitted Diseases 3583 LSB - Herms	Lecture Mosquito Identification 204 AgH - Freeborn	Lecture Fresh Water Drainage 3598 LSB Gray	Lecture History of Mosquito Control 3583 LSB Gray	Lecture and Demonstration Maps and Mapping 3590 LSB Gray
2 10 p m to 3 00 p m	Laboratory Use of the Microscope etc 204 AgH - Potts	Lecture Outline of Mosquito Control Methods 3583 LSB Gray	Laboratory Mosquito Identification 204 AgH Potts		Lecture Recent Experimental Control Methods 3583 LSB Freeborn	
3 10 p m to 4 00 p m	Laboratory Mosquito Morphology 204 AgH Potts				Lecture Salt Marsh Drainage and Reclamation 3583 LSB Gray	
4 10 p m to 5 00 p m						
7 30 p m to 9 30 p m		Seminar The Literature on Mosquitoes Herms 204 AgH - Stewart		Motion Pictures 3590 LSB	Seminar Climatology in Relation to Mosquito Control Herms Gray -	

TIME	SECOND WEEK 11 MONDAY	12 TUESDAY	13 WEDNESDAY	14 THURSDAY	15 FRIDAY	16 SATURDAY
8 10 a m to 9 00 a m	Lecture Screening 3583 LSB Gray	Lecture Filling and Pumping 3583 LSB Gray	Lecture Accounts 3583 LSB Gray	Lecture Wildlife Conservation and Mosquito Control 3583 LSB Herman	Lecture Naturalistic Control Methods 3583 LSB Gray	
9 10 a m to 10 00 a m	Lecture Mosquito Control Work of Calif State Dept of Public Health 3583 LB Reinke	Lecture Emulsifiers 3583 LB Craig	Lecture Mosquito Control Work of U S Public Health Service 3583 LSB Freeborn	Lecture Personnel Selection and Training Hansgen Gray 3583 LSB	Lecture Mosquito Control under Tropical Conditions 3583 LSB Herms	Lecture Public Information 3583 LSB Van Ellen
10 10 a m to 11 00 a m	Lecture Reports 3583 LSB Gray	Lecture Flushing 3583 LSB Gray	Lecture Equipment 3583 LSB Gray	Lecture and Discussion Fish as Control Agencies 3583 LSB Freeborn	Lecture Comparative Costs of Drainage 3583 LSB Gray	
11 10 a m to 12 00 noon	Lecture Geographical Distribution of Mosquitoes 3583 LSB Herms	Lecture Filariasis 3583 LSB Reich		Lecture Encephalitis 3583 LSB Reeves	Lecture Comparative Costs of Larvicides 3583 LSB Gray	
1 10 a m to 2 00 p m	Lecture and Demonstrations Oils 3583 LSB Gray	Lecture and Demonstrations Larvicides 3583 LSB Gray	Lecture Special Types of Control Measures - Rural 3583 LSB Gray	Lecture Special Types of Control Measures Urban 3583 LSB Gray	Lecture Repellents 3583 LB Herms	Examination 3590 LSB
2 10 p m to 3 00 p m	Lecture Finding Mosquito Breeding Places 3583 LSB Herms Gray				Lecture Organization and Annotation of Districts 3583 LSB Gray	
3 10 p m to 4 00 p m			Lecture Epidemiology of Malaria 3583 LSB Wynns	Lecture City Health Departments and Mosquito Control 3583 LSB Bissell	Lecture and Discussion Relation of Districts to other Agencies 3583 LSB Reinke	Concluding Lecture Dr. Brown 3583 LSB
4 10 p m to 5 00 p m					Lecture Economic Effects of Mosquito Control 3583 LSB Gray	
7 30 p m to 9 30 p m	Seminar Mosquito Survey Methods 204 AgH Freeborn Herms Gray	Seminar The Literature on Mosquito Control 3590 LSB Gray		Seminar Planning Control Campaigns 3590 LSB Herms Gray		

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EDITORIAL SECTION

AN ANNIVERSARY RE-APPRAISAL

With the March, 1945, number, MOSQUITO NEWS will mark the anniversary of its extension in geographic scope through its affiliation one year ago with the newly launched American Mosquito Control Association. At such a time it is fitting that we should pause briefly to re-examine our perspective with reference to our background, and to the general objectives, the responsibilities, and the major services that are appropriate functions of the Association and its official journal, MOSQUITO NEWS.

With a few exceptions, the females of all mosquito species feed upon the blood of birds and mammals, including man. Such mosquitoes are "pest" mosquitoes.

In the course of this intimate relation of the mosquito and its source of blood meals, some pest mosquitoes have become carriers of a third factor in the associated group of organisms, of which the parasites of malaria and of filariasis, and the virus bodies of yellow fever, dengue, and encephalitis are examples.

The resulting man-to-mosquito-to-man cycle of the corresponding diseases may be effectually broken by elimination of the mosquito vector.

The effectual suppression of pest mosquitoes in a locality would automatically suppress all of the associated mosquito borne diseases.

Sometimes, however, the mosquito carriers of a particular mosquito borne disease may be effectually suppressed by special control measures at lower cost than would be required for the supression of all of the associated pest mosquitoes. Frequently such partial measures based upon special knowledge of mosquito habits may be justifiable as economically sufficient, or all that is economically practicable.

In the early years, work with mosquitoes as possible carriers of disease fell logically to medical men. Fifty years ago there were few professional entomologists; and most of the earlier work with insects had been carred on as a hobby by doctors, lawyers, clergymen, bankers, and the like. Control work when ultimately called for fell logically to the engineer.

As a result there has grown up a tradition among mosquito control workers that mosquito control work is the province of the medical man and the engineer; with the entomologist (thought of as the traditional "butterfly chaser") expected to contribute little except to "count the spots on mosquitoes' wings."

On the contrary, however, within the past two score years the "practical" pro-

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EDITOR'S NOTE: The schedule of this course reproduced (See also MOSQUITO NEWS for December, 1944) and Mr. Gray's comment taken from a letter to the editor and printed here, may be suggestive and helpful to officers of institutions in other regional areas that may contemplate offering a similar course.

"We have just completed an intensive two weeks' course on the control of mosquitoes and mosquito transmitted diseases, sponsored by the School of Public Health of the University of California. For your information, I am enclosing a schedule of the course."

"Twenty-four men were enrolled, most of them coming from mosquito abatement districts in California, plus men from federal, state and local health departments, with one man from Washington State and another from Utah State."

"Our experience with this intensive course indicates that if another should ever be given it should be expanded to at least a month, one or two days allotted to field demonstrations and an appreciable amount of time left free for study. However, we did the best we could under war conditions."

(Signed) HAROLD F. GRAY.

fession of economic entomology has grown to huge proportions; such that the American Association of Economic Entomologists now has a membership of approximately 1800, largely in public service.

Many of these "practical" entomologists have concerned themselves with the habits and behavior of mosquitoes and with the critical relations of these insects to their environment, as well as with their classification. As a result, control of mosquito borne diseases has become much more precisely specialized; and to assure efficient work, medical men, engineers, investigators, and public officials concerned with their control must themselves become competent entomologists within this special field, or must enlist the collaboration of the trained entomologist.

Not only has the control of mosquitoes and mosquito born diseases become more specifically exacting, but mosquito control workers are coming more and more to be charged with control of other insect borne diseases. For example, where flea borne plague is endemic, as in Hawaii, the rat and mosquito squads may properly give more attention to rat control and rat proofing than to mosquito control; control of tick borne spotted fever will almost certainly be added to the duties of mosquito abatement commissions in many areas; and where other insect borne diseases may be effectually suppressed by control of their insect vectors, the mosquito control worker may be required also to assume responsibility for this.

Furthermore, our knowledge of insect borne diseases and their control is continuing to advance with rapidly increasing velocity as a result of investigations variously shared by practical control workers, medical men, entomologists, and laboratory technicians. Results of these investigations reported and interpreted to the field worker may point the way to advantageous readjustments of control techniques; and, in turn, developments in the field brought to the attention of the laboratory worker may help to direct his efforts and accelerate his progress.

The American Mosquito Control Association and MOSQUITO NEWS constitute a dual agency which may have an important part in passing on from each group to the others, appropriate results produced by the work of the medical man, the entomologist, the engineer, and the laboratory investigator; and thus in helping to coordinate their activities and to bring their respective technical contributions into earlier effective use.

Owing to his increasingly diverse responsibilities in different areas, it would seem also that adequate service to the mosquito control worker himself and to the public health official, as well as to those who participate less directly in this field and to the public, would require of the Association and MOSQUITO NEWS coverage of the general field of medical entomology, of which mosquitoes and the diseases they carry have long constituted the major part.

The editor and the publications committee will welcome comments and suggestions on this point.

REVIEWS AND ABSTRACTS

PRACTICAL MALARIA CONTROL, A HANDBOOK FOR FIELD WORKERS. By Carl E. M. Gunther, 1944. With foreword by Prof. Harvey Sutton, 91 pages. Published by Philosophical Library, Inc., 15 East 40th Street, New York. (The price is listed at $2.50.)

In his foreword Prof. Sutton points out that Dr. Gunther has spent many years as Medical Officer in the Mandated Territory of New Guinea in the midst of the tropical jungle, and in an area where malaria is highly endemic. In addition to being a successful physician, Doctor Gunther is also an entomologist of note.

The book is written in four parts; Part I deals with Antimalarial Measures (pp. 9-39); Part II deals with Diagnosis (pp. 40-59); Part III, Treatment (pp. 60-82); Part IV, Complications of Malaria, — blackwater fever and herpes (pp. 83-91).

Gunther points out that malaria control aims at reducing the important breeding grounds, protecting the majority of inhabitants from mosquities, and reducing the number and severity of attacks of malarial fever per inhabitant (the entire elimination of the infection is not the object). By comparison with elimination its cost is negligible, and it achieves results which are satisfactory for all working purposes.

He emphasizes the importance of knowing which of the local species of *Anopheles* are vectors and what their breeding habits are. This he illustrates by citing a situation in which malaria was rampant in spite of what seemed to be a favorable hillside location near some clear springs and streams, a lower swampy location having been declared dangerous. It was found that the swamp-breeding species was not a vector in that district, and that the vector was a species which bred in the clear sunlit running streams. The solution of the problem, however, was not to move the community away from the hillside breeding places, but rather to make the sunlit foci unsuitable by growing shade trees and overhanging shrubs.

The booklets contains practical standard advice on general methods of treating breeding places. It is pointed out that complete screening of houses is the most important single measure against malaria. The real difficulty in screening is the style of tropical houses. Suggestions are made as to how to meet this difficulty. There are some excellent pointers on standards of living in the tropics.

Every physician who elects to practice his profession in tropical malarial regions will be indebted to Doctor Gunther for this very useful booklet.—W. B. Herms, Department of Entomology and Parasitology, University of California, Berkeley.

THE MORPHOLOGY AND BIOLOGY OF *Culex molestus:* OBSERVATIONAL NOTES FOR INVESTIGATORS. By J. F. Marshall, 1944. British Mosquito Control Institute (Hayling Island, Hants), No. 34, 15 pp., 11 figs., 2 tabs., 15 refs.

Written with the purpose of collecting information on the habits of *Culex molestus,* this pamphlet, put out by the British Mosquito Control Institute, clearly outlines definite morphological and biological characters to distinguish this species from *Culex pipiens,* with which it was confused in England until October 1934. As little is known regarding the habits and breeding places of *C. molestus,* the author has given explicit instructions for collecting mosquitoes and differentiating them from other insects. In addition, he has indicated the type of data to be submitted with specimens. These include locality, kind of water, location of water, degree of infestation, whether insect was caught biting or resting on a wall, and other needed facts. Sufficient information is given so that a person not trained in entomology could collect specimens and send in records of much value to the Institute.

As an aid in separating *Culex molestus* and *C. pipiens,* many excellent diagrammatic photographs and drawings appear throughout the paper. Records of *C. molestus* are well tabulated and show almost at a glance the history of the situation up to 1943. Of particular interest to entomologists is a list of mosquitoes occurring in Britain, given at the end of the paper.

In a compact 15 pages the results of studies gathered on *Culex molestus* up to the end of 1943 are given. This attempt on the part of the British to gain more facts about an insect of economic importance by putting out such a pamphlet is an excellent idea. The plan might well be followed by other groups of entomologists to further the gathering of data on insects or arachnids concerning the habits of which we are in doubt or about which we possess scanty information.—Helen Sollers, Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, U. S. Department of Agriculture, Washington, D. C.

DICHLORO-DIFENIL-TRICHLORO-ETANO (DDT) NO COMBATE AS LARVAE DE CULICIDEOS. [DDT IN THE CONTROL OF COLICINE LARVAE.] By R. Wasick and O. Unti. Arquivos de Higiene e Saude Publica 9(21): 87-102. 1944. Sao Paulo, Brazil.

Out of Brazil comes a detailed paper in which the results of two investigations are presented, (1) DDT as a larvicide and ovicide, and (2) the toxicological effects of DDT on laboratory animals.

The authors relate their experiments with DDT in various concentrations against larvae of *Culex* sp., *C. quinquefasciatus, Anopheles* sp., *A. stroedi,* and *A. albitarsis* placed in aquaria simulating

their natural habitats. All strengths of DDT from 1 part per 1000 parts of water to 1 part per 60 million parts killed the larvae. The time required to kill all the larvae depended upon the amount of DDT used. The authors seem to agree with other entomological workers in their findings on the long-lasting properties of DDT. In the strengths tested in the aquaria containing larvae of the above-mentioned species, DDT retained its efficiency for 4 months. The results are arranged clearly in a table.

DDT in colloidal suspensions and as dusts was also tested in accumulations of natural water such as puddles and pools created by heavy rains. In either form this material was successful in killing mosquito larvae, but it was found that larvae died more quickly when DDT was applied in water suspensions than as dusts.

When daily dosages of DDT were administered to a limited number of domestic animals, no injurious effects were noted from the following total dosages, except as indicated: Two dogs each fed 7.75 grams in 31 days; two cats fed 0.315 and 0.048 gram in 6 days and two given intramuscularly 0.048 and 0.072 gram in 6 days; six rats each given orally 1.2 grams in 6 days (1 died); two mice each given intramuscularly 0.015 gram in 5 days (both grew thin), and two mice each fed 0.015 gram in 5 days; three pigeons given intravenously 0.024, 0.034, and 0.041 gram in 5 days, two given intramuscularly 0.015 and 0.034 gram in 5 days, and two fed 0.036 and 0.050 gram in 5 days; one chicken given intravenously 1.0 gram in 5 days, and another fed 2.0 gram in 5 days.

Frogs (*Leptodactylus ocellatus*) and toads (*Bufo marinus*) were exposed 2 to 3 hours daily for 4 days in a vivarium treated with 0.2 gram of DDT per 12,500 liters of water without any ill effects. Some fish which were also exposed succumbed, and experiments are to be continued with other species. The authors believe that DDT used in the proportions they recommend for larvicides would not be harmful to man or domestic animals, or to the frogs and toads tested. The possibility of using DDT in drinking water at the rate of 1 gram per 25,000 liters (approximately 1 part in 25,000,000) is foreseen.

DDT powder has been found to cause no irritation or burning on the skin of man for 24 hours after application in various concentrations or in the pure state.

An added feature of the paper is the English summary, which gives a rather full account of the material presented. The statement in the summary referring to the ovicidal effect of DDT is confusing, but the text makes it clear that mosquito eggs did hatch in treated water and that the larvae died immediacly after hatching.

In general the results obtained by Wasicky and Unti are in accord with the findings of Knipling and associates, Calvery, and Neal in the United States, much of which has not yet been published for security reasons. The recording of data on the effect of DDT on various species of mosquitoes under different conditions is of distinct value. The authors are continuing their work, and we look forward to further progress with this important insecticide under tropical conditions.— Helen Sollers, Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, U. S. Department of Agriculture, Washington, D. C.

TOXICITY OF DDT AND THANITE SPRAYS TO ADULTS OF ANOPHELES QUADRIMACULATUS SAY. By Paul L. Rice, Carl B. Huffaker and Richard C. Back. Abstract of a paper read at the Entomological Society meetings in New York City, December 13-15, 1944.

This study was initiated in an attempt to develop satisfactory substitutes for pyrethrum in adult mosquito sprays. Experiments were conducted with *Anopheles quadrimaculatus* adults both in the laboratory and in the field. The laboratory tests were carried out in a Peet-Grady chamber using the standard procedure for flies with two exceptions: (1) only 6 ml. of spray was used and (2) the exposure was reduced to 2½ minutes. Records were kept on the per cent of knockdown at the end of the exposure period and the per cent of kill after 24 hours. Field tests were conducted in a cattle shed, open on one side. Cages containing *A. quadrimaculatus* adults were hung within a test area on the wall comprising 48 square feet, and 6.5 ml. of spray was used to cover this area. Evaluations of the test materials were made on the basis of knockdown after 5 minutes and kill after 24 hours. The toxicants employed in all tests were in solution in deodorized kerosene.

The laboratory tests showed that one per cent DDT gave only a 57 per cent knockdown but a 24-hour mortality of 100 per cent. A one per cent Pyrethrol "20" spray gave excellent knockdown (97 per cent) and kill (94 per cent). One per cent of a combination of 20 per cent DDT and 80 per cent Thanite gave results which compared quite closely with the Pyrethrum, namely, 92 per cent knockdown and 96 per cent kill; while the corresponding results for the spray made up of one per cent of a combination of 40 per cent DDT and 60 per cent Thanite were 86 per cent knockdown and 99 per cent kill.

The poor knockdown produced by DDT alone in the laboratory led the investigators to restrict field tests to combinations of DDT and Thanite, using Pyrethrum as a standard spray for comparison. The results obtained from nine replications were as follows: 1.5 per cent Pyrethrol 20—88 per cent knockdown and 73 per cent kill; 1.5 per cent of a combination of 20 per cent DDT and 80 per cent Thanite—86 per cent knockdown and 94 per cent kill; 1.5 per cent of a combination of 40 per cent DDT with 60 per cent Thanite—84 per cent knockdown and 98 per cent kill. Both the DDT-Thanite sprays gave good results, but the 20-80 combination appears to be particularly promising.

Authors' abstract. (Original article to be published in the magazine *Soap and Sanitary Chemicals* for March, 1945.)

TOXICITY OF DDT TO FISH. By Joseph M. Ginsburg, New Jersey Agricultural Experiment Station, New Brunswick. Author's abstract of a paper read at the Entomological Society meetings in New York City, December 13-15, 1944.

Observations in the course of field experiments with mosquito larvicides containing DDT have shown this chemical to be toxic to black bass, catfish and salt water minnows. Laboratory experiments, conducted during the summer of 1944, with various concentrations of DDT in the form of (1) colloidal solutions, (2) oil emulsions, and (3) dusts, have brought out its rather high toxicity to goldfish. It appears from these experiments that DDT is most toxic to goldfish when in colloidal solution, less toxic in the form of oil emulsion applied on the surface, and least toxic when applied on the surface in the form of dust. In each case, however, the toxicity is sufficiently high to caution against unrestricted use of DDT on mosquito breeding waters where fish, worth preserving, prevail. Author's Abstract.

DDT RESIDUAL HOUSE SPRAYING IN RURAL AREAS—COSTS AND EFFECTIVENESS. By Frederick L. Knowles and Clinton S. Smith. Abstract of a paper read at the Entomological Society meetings in New York City, December 13-15, 1944.

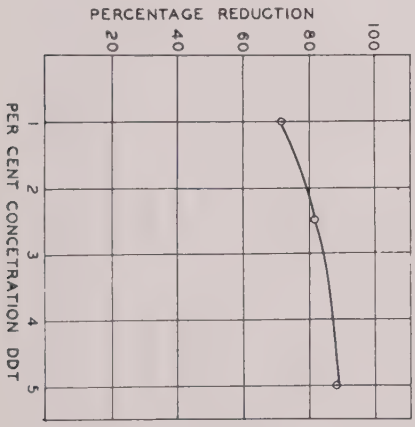

Fig. '. Percentage reduction of resting female *A. quadrimaculatus* adults in sprayed houses compared to unsprayed houses plotted against DDT concentration of spray (a 5% DDT spray produces a deposition of 64 mgs. of DDT per sq. ft.)

To determine the effectiveness as well as the cost of DDT residual house spraying as a possible practical method of malaria control in rural areas, the Office of Malaria Investigations, during the summer of 1944, sprayed 513 tenant houses in a rural area, approximately 36 square miles in extent, near Helena, Arkansas.

Detailed records were kept of the time required for each operation and the quantity of materials used. For a two-month period following the spraying operations, the sprayed houses as well as unsprayed houses were carefully searched for resting adult *A. quadrimaculatus* mosquitoes.

The operations data show that an average of 2,400 square feet in each of 20 houses were sprayed per day; that the average amount of spray material per house was 0.82 gallons and that the total time per house was 21.8 minutes, approximately half of which was traveling time. Two operators were employed, so that in terms of man-hours and cost each house required 0.73 man-hours at a cost of 35 cents, and 0.82 gallons of spray is estimated at 39 cents, so that labor and material costs for each house were 74 cents.

Inspection of 166 unsprayed houses and 174 sprayed houses for resting adult *A. quadrimaculatus* showed for the two-month period following spraying a reduction of the mosquito population in the spryed houses of 94, 81, and 66 per cent for the 5, 2½, and 1 per cent DDT concentration spray, respectively. Author's Abstract.

TOXICITY OF DDT FOR MAMMALS. By Herbert O. Calvery, Chief, Division of Pharmacology, Food and Drug Administration, Federal Security Agency, Washington, D. C. Abstract of a paper read at the Entomological Society meetings in New York City, December 13-15, 1944.

This presentation consists of a brief resume of our toxicological studies of DDT along the following lines:

1. Acute and subacute application to the skin of rabbits, rats, guinea pigs and dogs.
2. Acute and subacute feeding to rats, mice, guinea pigs, chicks, rabbits, dog, sheep, horse, cow.
3. Chronic feeding to rats and dogs.
4. Skin irritation and sensitization.
5. Pharmacological investigations as to the site and mode of action.
6. Gross and microscopic pathology and blood studies of poisoned animals.

In solid form DDT applied topically to the skin is nonirritating, nonsensitizing and not appreciably absorbed. In solution, either in oil or in organic solvent, it does readily penetrate the skin, is very mildly irritating and a very mild sensitizing agent.

In single and multplie dose administration (acute and subacute) there are wide individual as well as wide species variations.

In the prolonged feeding experiments (chronic toxicity) rats have been fed for about 18 months diets containing 100, 200, 400 and 800 p.p.m. Guinea pigs, dogs and monkeys have been sudied for shorter periods.

The pharmacological manifestations of effect from DDT are principally loss of appetite, mild to severe tremors of central nervous system origin, convulsions and death. Tremors can be prevented or abolished by general anesthetics and narcotics.

Histopathologic examination of tissues of animals which have received DDT shows tissue damage, but it is neither striking nor characteristic for all species. Author's Abstract.

A STUDY OF DINITRO-PHENOL COMPOUNDS AS MOSQUITO LARVICIDES. By H. I. Magy and W. M. Hoskins. Abstract of a paper read at the Entomology Society meetings in New York City, December 13-15, 1944.

Solutions of 3, 5 dnitro-*o*-cresol, 2, 4 dinitro-6-cylohexyl phenol or dicyclohexylamine salt of 2, 4 dinitro-6-cyclohexyl phenol are toxic to larvae of the mosquito *Culiseta incidens* only at relatively high concentrations, but if only small amounts of suspended particles of the two latter compounds are present high mortality results within 24 to 48 hours or less. Hence they function as stomach rather than as contact poisons. Field trials with dusts applied in the weeds and reeds along an irrigating ditch gave high kill of *Anopheles maculipennis* larvae with dusts containing 10 per cent 2, 4 dinitro-6-cyclohexyl phenol or 40 per cent of the dicyclohexyl amine salt, each applied at rate of 50 pounds to the acre. Author's Abstract.

ECONOMIC ENTOMOLOGY AND APPLIED ECOLOGY. By Z. P. Metcalf. The interrelations between economic entomology and ecology are numerous and very close. In fact there is a science of economic entomology today because the early settlers on this continent disturbed the ecological climaxes that had developed here. A great deal of time, energy and money are devoted to the control of insect pests of farm, field, orchard, and garden. Much of this effort is wasted because the methods of control must be our chief reliance in dealing with the pests of orchards and gardens where a slight amount of damage detracts greatly from the useability of the products. This is especially true in orchards where rotation and other similar practices cannot be followed. But for most of the field crops, where return per acre is so low that the application of insecticides is impractical, indirect methods of control based upon ecological principles must be used. Author's Abstract.

THE RELATION BETWEEN THE TOXICITY OF DDT AND THE POSSESSION OF A CHITINOUS EXOSKELETON IN ANIMALS. By A. Glenn Richards, Jr., and Laurence K. Cutkomp.

Analyses of DDT toxicity through the series of animal phyla showed high toxicity only for those groups which possess a chitinous exoskeleton. The most critical data come from studies on closely related forms of Coelenterates with respectively complete, partial and no chitinous cuticle (perisarc). A negative temperature coefficient for DDT action under certain conditions favors the idea that the reaction involves adsorption phenomena, though clearly other phenomena are also involved. Direct tests with isolated chitinous cuticles and purified chitin show that DDT can be adsorbed by such exoskeletons. Tests with several standard cell systems show less, usually negative, results.

These data are consistent with the hypothesis that the arthropod cuticle is a system which selectively concentrates DDT by adsorption phenomena and somehow transmits it to its effective locus within the animal. This concentration phenomenon may be, in a sense, independent of the physiological action of DDT within the animal.

Authors' Abstract.

Editor's Note: There remains the question why, of equally chitinized and rather closely related insect species, some may be easily killed by DDT, while other are highly resistant.

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Shovels, Power:
Bay City Shovels, Inc., 2611 Center Ave., Bay City, Mich.

Steel, Reinforcing:
United States Steel Supply Co., 1319 Wabansia Ave., P. O. Box MM, Chicago, Ill.

Tanks:
Graver Tank & Mfg. Co., Inc., 6300 Tod Ave., East Chicago, Ind.

Tractors:

R. E. BROOKS CO., 50 Church St., New York 7, N. Y.
Arthur D. Peterson Co., Inc., 420 Lexington Ave., New York, N. Y.
Minneapolis-Moline Power Implement Co., Box 1050, Minneapolis 1, Minn.
Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Baker Mfg. Co., 1000 Stanford Ave., Springfield, Ill.

Weed Burners:

White Manufacturing Co., 1941 McKay St., Elkhart, Ind.
Hauck Mfg. Co., 124-136 10th St., Brooklyn 15, N. Y.

C. SHOP AND MAINTENANCE EQUIPMENT AND SUPPLIES:

General:

The Charles Parker Co., 412 Jordan St., Meridan, Conn.
Acme Rubber Mfg. Co., 90 West Broadway, New York, N. Y.
Globe Sanitary Supply Co., 2249 E. 38th St., Los Angeles 11, Calif.

Agitators, Mixing:

H. K. Porter Co., Inc., 1932 Oliver Bldg., Pittsburgh 22, Penna.
Denver Equipment Co., 1400 17th St., Denver, Colo.
Jaeger Machine Co., Columbus, Ohio.
The DeVilbiss Co., Toledo 1, Ohio.

Air Compressors:

Jaeger Machine Co., Columbus, Ohio.
R. C Stanhope Co., 60 E. 42nd St., New York, N. Y.
American Brake Shoe, Kellog Division, Rochester 9, N. Y.
Yeomans Bros. Co., 1469 N. Dayton St., Chicago 22, Ill.
Quincy Compressor Co., 304 Maine St., Quincy, Ill.

Aprons:

Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Pa.
Eimer & Amend, 635 Greenwich St., New York 14, N. Y.
Pioneer Rubber Co., 300 Tiffin Road, Willard, Ohio.

Ball Mills:

H. K. Porter Co., Inc., 1932 Oliver Building, Pittsburgh 22, Pa.
Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Denver Equipment Co., 1400 17th St., Denver, Colo.

Batteries, Storage:

Electric Storage Battery Co., Philadelphia 32, Pa.

Battery Cells, Flashlights:

Ideal Commutator Dresser Co., 1006 Park Ave., Sycamore, Ill.
Burgess Battery Co., Freeport, Ill.
National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.

Blow Torches:

Hauck Mfg. Co., 124-136 10th St., Brooklyn 15, N. Y.

Cutting Torches, Gas:

Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.

Drill Bits:

Greenfield Tap & Die Corp., 39 Sanderson St., Greenfield, Mass.
Snap-On Tools Corp., 8028 - 28th Ave., Kenosha, Wis.

First Aid Kits:

Macy's, New York, N. Y.
Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Pa.
Eimer & Amend, 635 Greenwich St., New York 14, N. Y.
Mine Safety Appliances Co., 230 N. Braddock Ave., Pittsburgh 8, Pa.
Western Fire Equipmant Co., 69 Main St., San Francisco, Calif.

Fire Extinguishers:

National Foam System, Inc., 1410 Packard Building, Philadelphia 2, Pa.
American-Lafrance Foamite Corp., 903 Erie St., Elmira, N. Y.
M. L. Snder & Son, Jasper and York Sts., Philadelphia 25, Pa.
Fenwick Mfg. Co., 136 Rome St., Newark, N. J.
C-O Two Fire Equipment Co., U. S. Highway No. 1, Newark 1, N. J.
Goodall Rubber Co., 7 S. 36th St., Philadelphia 4, Pa.
Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Pa.
Safety First Extinguisher Co., 291 Seventh Ave., New York, N. Y.
Eimer & Amend, 635 Greenwich St., New York 14, N. Y.
Western Fire Equipment Co., 69 Main St., San Francisco, Calif.

Flashlights:

Ideal Commutator Dresser Co., 1006 Park Ave., Syramore, Ill.
Macy's, New York, N. Y.
Burgess Battery Co., Freeport, Ill.
National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.

Gasoline Pumps:

Western Fire Equipment Co., 69 Main St., San Francisco, Calif.
Jaeger Machine Co., Columbus, Ohio.

Gloves:

Mine Safety Appliances Co., 230 N. Braddock Ave., Pittsburgh 8, Pa.
American Optical Co., 1940 Thomas St., Southbridge, Mass.
Pioneer Rubber Co., 300 Tiffin Road, Willard, Ohio.
M. L. Snyder & Son, Jasper and York Sts., Philadelphia 25, Pa.

Goggles:

Safety Fire Extinguisher Co., 291 Seventh Ave., New York, N. Y.
Eimer & Amend, 635 Greenwich St., New York 14, N. Y.
Mine Safety Appliances Co., 230 N. Braddock Ave., Pittsburgh 8, Pa.
American Optical Co., 1940 Thomas St., Southbridge, Mass.

Grinders:

Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Pa.
United States Steel Supply Co, 1319 Wabansia Ave., P. O. Box MM, Chicago 90, Ill.

Hammers:

Fayette R. Plumb, Inc., 4837 James St., Philadelphia 37, Pa.
Cornwell Quality Tools Co., 1016 N. Cleveland St., Mogadore, Ohio.

Hoists:

Lanebro Manufacturing Co., Poughkeepsie, N. Y.

Hose, Rubber:

Acme Rubber Mfg. Co., 90 West Broadway, New York, N. Y.
Macy's, New York, N. Y.
Goodall Rubber Co., 7 S. 36th St., Philadelphia 4, Pa.
Thermoid Co., Whitehead Road, Trenton 6, N. J.
Hewitt Rubber Corp., Central and Kensington Aves., Buffalo, N. Y.
Safety Fire Extinguisher Co., 291 Seventh Ave., New York, N. Y.
Western Fire Equipment Co., 69 Main St., San Francisco, Calif.
M. L. Snyder & Son, Jasper and York Sts., Philadelphia 25, Pa.
Arthur D. Peterson Co., Inc., 420 Lexington Ave., New York, N. Y.

Hose, Oil Resistant:

Thermoid Co., Whitehead Road, Trenton, N. J.
The DeVilbiss Co., Toledo 1, Ohio.
Hewitt Rubber Corp., Central and Kensington Aves., Buffalo, N. Y.
Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.
Arthur D. Peterson Co., Inc., 420 Lexington Ave., New York, N. Y.
Columbia Steel Tank Co., Kansas City 7, Mo.
Goodall Rubber Co., 7 S. 36th St., Philadelphia 4, Pa.

Jacks:

Blackhawk Mfg. Co., 5325 W. Rogers St., Milwaukee 1, Wis.

Leather:

Graton & Knight Co., 342 Franklin St., Worcester 4, Mass.

Lathes:
South Bend Lathe Works, 425 E. Madison St., South Bend 22, Ind.

Lights:
The Portable Light Co., Inc., 216 William St., New York 7, N. Y.

Mixers, Emulsion:
H. K. Porter Co., Inc., 1932 Oliver Building, Pittsburgh 22, Pa.

Oils, Lubricating:
Grafo Colloids Corp., 340 Wilkes Place, Sharon, Pa.
Pennsylvania Grade Crude Oil Association, Oil City, Pa.

Pipe Fittings:
Chase Brass & Copper Co., 1939 Rodney St., Waterbury 91, Cann.
Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.
Columbia Steel Tank Co., Kansas City 7, Mo.

Pumps:
Yeomans Bros. Co., 1469 N. Dayton St., Chicago 22, Ill.
Gould Pumps, Seneca Falls, N. Y.
Blackmer Rotary Pump Co., Grand Rapids, Mich.
The Carver Pump Co., 1056 Hersey Ave., Muscatine, Iowa.
Gray-Mills Co., 1948 Ridge Ave., Evanston, Ill.

Saws, Hack:
Cornell Quality Tools Co., 1016 N. Cleveland St., Mogadore, Ohio.

Solders and Fluxes:
Chase Brass & Copper Co., 1939 Rodney St., Waterbury 91, Conn.
Gardiner Metal Co., 4838 S. Campbell Ave., Chicago 32, Ill.

Soldering Iron:
Ideal Commutator Dresser Co., 1006 Park Ave., Sycamore, Ill.

Tanks, Storage:
R. C. Stanhope, Inc., 60 E. 42nd St., New York, N. Y.
Denver Equipment Co., 1400 17th St., Denver, Colo.
Columbia Steel Tank Co., Kansas City 7, Mo.
Chicago Steel Tank Co., 6400 W. 66th St., Chicago, Ill.

Tools, Hand:
Nicholson File Company, 23 Acorn St., Providence 1, Rhode Island.
Stanley Tools, 111 Elm St., New Britain, Conn.
Fayette R. Plumb, Inc., 4837 James St., Philadelphia 37, Pa.
Cornwell Quality Tools Co., 1016 N. Cleveland St., Mogadore, Ohio.
Greenfield Tap & Die Corp., 39 Sanderson St., Greenfield, Mass.
Macy's, New York, N. Y.

Tools, Power, Bench, Floor, etc.:
United States Steel Supply Co., 1319 Wabansia Ave., P. O. Box MM, Chicago 90, Ill.
The Cincinnati Tool Co., Norwood, Cincinnati 12, Ohio.
Snap-on Tools Corp., 8028 28th Ave., Kenosha, Wis.
George Gorton Machine Co., 1321 Racine St., Racine, Wis.

Tools, Power, Portable:
Snap-on Tools Corp., 8028 28th Ave., Kenosha, Wis.
George Gorton Machine Co., 1321 Racine St., Racine, Wis.
The Black & Decker Mfg. Co., Towson 4, Md.

Vises:
Snap-on Tools Corp., 8028 28th Ave., Kenosha, Wis.
Production Devices, Inc., N. Williams St., Whitehall, N. Y.

Welders, Electric:
Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Hobart Bros. Co., Troy, Ohio.
Acro Welder Mfg. Co., Inc., 1831 St. Paul Ave., Milwaukee, Wis.
Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich.
The Federal Machine & Welder Co., 212 Dana St., Warren, Ohio.

Welders, Gas:

Imperial Equipment Co., 1200 W. Harrison St., Chicago, Ill.
Victor Equipment Co., 850 Folsom, San Francisco, Calif.

Welding Supplies:

United States Steel Supply Co., 1319 Wabansia Ave., Chicago 90, Ill.
Hobart Bros. Co., Troy, Ohio.
Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich.
Victor Equipment Co., 850 Folsom, San Francsco, Calif.

Wrenches:

Lowell Wrench Co., Worchester, Mass.

D. INSECT CONTROL, MATERIALS, EQUIPMENT AND SUPPLIES: (For Mosquitoes and Other Disease Carriers)

General:

Phillips & Benjamin Co., 475 Fifth Ave., New York 17, N. Y.
Hammill & Gillespie, 225 Broadway, New York, N. Y.
Globe Sanitary Supply Co., 2249 E. 38th St., Los Angeles 11, Calif.
Stanco, Incorporated, 216 W. 14th St., New York, N. Y.
Harshaw Scientific, Div. of The Harshaw Chemical Co., 1945 E. 97th St., Cleveland 6, Ohio.
SEACOST LABORATORIES, Inc., 156 Perry St., New York, N. Y.

Antimalarials:

Merck & Co., Inc., Rahway, N. J.

Barium Carbonate:

Mallinckrodt Chemical Works, Mallinckrodt St., St. Louis 7, Mo.

Bentonites

Tamms Silica Co., 228 N. LaSalle St., Chicago, Ill.
American Cynamid & Chemical Corp., 30 Rockefeller Plaza, New York 20, N. Y.

Blue Vitriol:

Mallinckrodt Chemical Works, Mallinckrodt St., St. Louis 7, Mo.

Chemicals:

Reilly Tar & Chemical Corp., Merchants Bank Building, Indianapolis 4, Ind.

Clays:

Tamms Silica Co., 228 N. LaSalle St., Chicago, Ill.
American Cynamid & Chemical Corp., 30 Rockefeller Plaza, New York 20, N. Y.
Hammill & Gillespie, 225 Broadway, New York, N. Y.

Copper Sulfate, Monohydrated:

Chipman Chemical Co., Inc., Bound Brook, N. J.

Cresols and Creslyic Acid:

American-British Chemical Supplies, Inc., 180 Madison Ave., New York, N. Y.
James Good Co., 2214 E. Susquehanna Ave., Philadelphia 25, Pa.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Mallinckrodt Chemical Works, Mallinckrodt St., St. Louis 7, Mo.

Cryolite:

Stauffer Chemical Co., Inc., 420 Lexington Ave., New York, N. Y.
Chipman Chemical Co., Inc., Bound Brook, N. J.

Dusters, Hand and Power:

Dobbins Mfg. Co., Elkhart, Ind.
Master Fan Corp., 1321 Channing St., Los Angeles 21, Calif.
E. C. Brown Co., 900 Maple St., Rochester, N. Y.
Jaeckh Mfg. Co., 3444 Colerain Ave., Cincinnati, Ohio.
Volume Sprayer Mfg. Co., Tulsa, Okla.
Andrew Wilson, Inc., Springfield, N. J.

DDT:

McLaughlin-Gormley-King Co., 1715 Fifth St., S. E., Minneapolis, Minn.
Merck & Co., Inc., Rahway, N. J.
Geigy Company, Inc. (Discoverers of DDT Insecticide), 89-91 Barclay St., New York 8, N. Y.

Emulsifiers:

L. Sonneborn Sons, Inc., 88 Lexington Ave., New York 16, N. Y.

Flea Powders:

An-Fo Manufacturing Co., 3129 Elmwood Ave., Oakland 1, Calif.

Flea Soaps:

Huntington Labora.ories, Inc., Huntington, Ind.

Oils:

American Mineral Spirits Co., 230 N. Michigan Ave., Chicago, Ill.
Pennsylvania Grade Crude Oil Association, Oil City, Pa.
Pennsylvania Refining Co., Butler, Pa.
The Union Oil Co. of California, 617 W. Seventh St., Los Angeles 14, Calif.

Gas Masks:

Western Fire Equipment Co., 69 Main St., San Francisco, Calif.

Household Sprays:

Huntington Laboratories, Inc., Huntington, Ind.
Velsicol Corp., 120 E. Pearson St., Chicago 11, Ill.
Midwest Oil Co., Minneapolis, Minn.
Chemical Supply Co., 225 Plymouth Building, Cleveland 15, Ohio.
Andrew Wilson, Inc., Springfield, N. J.
James Good Co., 2214 E. Susquehanna Ave., Philadelphia 25, Pa.
R. M. Hollingshead Corp., 844 Cooper Ave., Camden, N. J.
Gulf Oil Corp., 3800 Gulf Building, Pittsburgh, Pa.
Pennsylvania Refining Co., Butler, Pa.

Inert Carrier Dusts:

Hammill & Gillespie, 225 Broadway, New York, N. Y.

Keresone:

L. Sonneborn Sons, Inc., 88 Lexington Ave., New York 16, N. Y.
Gulf Oil Corp., 3800 Gulf Building, Pittsburgh, Pa
Pennsylvania Grade Crude Oil Associaion, Oil City, Pa.
The Pure Oil Co., 35 E. Wacker Drive, Chicago 1, Ill.

Knapsack Sprayers:

Western Fire Equipment Co., 69 Main St., San Francisco, Calif.
THE F. E. MYERS & BRO. CO., Ashland, Ohio.
Andrew Wilson, Inc., Springfield, N. J.
Dobbins Mfg. Co., Elkhart, Ind.

Oil, Fuel:

Pennsylvania Grade Crude Oil Association, Oil City, Pa.
Magnus, Mabee & Reynard, Inc., 16 Desbrosses St., New York 13, N. Y.
The Pure Oil Co., 35 E. Wacker Drive, Chicago 1, Ill.
American Mineral Spirits Co., 230 N. Michigan Ave., Chicago, Ill.

Oils, Larvcide:

DOGGETT-PFEIL CO., Springfield, N. J.
Velsicol Corp., 120 E. Pearson S.., Chicago 11, Ill.

Oils, Mosquito:

Shell Oil Co., 50 W. 50th St., New York, N. Y.
The Pure Oil Co., 35 E. Wacker Drive, Chicago 1, Ill.
Andrew Wilson, Inc., Springfield, N. J.

Paris Green:

Chipman Chemical Co., Inc., Bound Brook, N. J.

Pyethrum Extracts:

McLaughlin-Gormley-King Co., 1715 Fifth St., S. E., Minneapolis, Minn.
An-Fo Manufacturing Co., 3129 Elmwood Ave., Oakland 1, Calif.

Pyrophyllite:

Clinchfield Sand & Feldspar Corp., 618 Mercantile Trust Bldg., Baltimore, Md.

Rat Poisons:

American Cynamid & Chemical Corp., 30 Rockefeller Plaza, New York City 20, N. Y.
Huntington Laboratories, Inc., Huntington, Ind.
Wisconsin Pharmacal Co., Milwaukee, Wis.

Repellents:

Becker-Bischoff Chemical Co., 3408 W. Pine Blvd., St. Louis, Mo.
National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.
Wisconsin Pharmacal Co., Milwaukee, Wis.
Skol Company, Inc., 801 Second Ave., New York 17, N. Y.
Velsicol Corp., 120 E. Pearson St., Chicago 11, Ill.
Hubere Cosmetics, Chicago 6, Ill.
American Cynamid & Chemical Corp., 30 Rockefeller Plaza, New York 20, N. Y.

Respirators:

Andrew Wilson, Inc., Springfield, N. J.

Screen Wire Cloth:

Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.
Chase Brass & Copper Co., 1939 Rodney St., Waterbury 91, Conn.

Soaps:

Chemical Supply Co., 225 Plymouth Building, Cleveland 15, Ohio.
Chicago Sanitary Products Co., 3100 S. Throop St., Chicago 8, Ill.
Eagle Soap Corp., Huntington, Ind.
James Good Co., 2214 E. Susquehanna Ave., Philadelphia 25, Pa.
R. M. Hollingshead Corp., 84 Cooper Ave., Camden, N. J.
Crystal Soap & Chemical Co., Inc., 6300 State Road, Tacony, Philadelphia 35, Pa.
American Wire Fabrics Corp., 500 Fifth Ave., New York 18, N. Y.

Sodium Fluoride:

Merck & Co., Inc., Rahway, N. J.

Solvents:

Pennsylvania Refining Co., Butler, Pa.
L. Sonneborn Sons, Inc., 88 Lexington Ave., New York 16, N. Y.
Velsicol Corp., 120 E. Pearson St., Chicago 11, Ill.

Sprayers, Hand and Power:

Fumeral Company, Racine, Wis.
Dobbins Mfg. Co., Elkhart, Ind.
H. D. HUDSON & CO., 589 E. Illinois St., Chicago 11, Ill.
D. B. SMITH & CO., Inc., Utica, N. Y.
F. E. MEYERS & BROS. CO., Ashland, Ohio.
JOHN BEAN MFG. CO., Lansing 4, Mich.
HARDIE MFG. CO., Hudson, Mich.
Volume Sprayer Mfg. Co., Tulsa, Okla.
Fitzhenry-Guptill Co., 135 First St., East Cambridge, Mass.
Friend Mfg. Co., Gasport, N. Y.
American Mineral Spirits Co., 230 N. Michigan Ave., Chicago, Ill.
Stauffer Chemical Co., Inc., 420 Lexington Ave., New York, N. Y.
R. E. Chapin Mfg. Works, Inc., 29 Liberty St., Batavia, N. Y.
Arthur D. Peterson Co., Inc., 420 Lexington Ave., New York, N. Y.
Jaeckh Mfg. Co., 3444 Colerain Ave., Cincinnati, Ohio.
The DeVilbiss Co., Toledo 1, Ohio.
E. C. Brown Co., 900 Maple St., Rochester, N. Y.
Ideal Commutator Dresser Co., 1006 Park Ave., Sycamore, Ill.
Western Fire Equipment Co., 69 Main St., San Francisco, Calif.

Talc:

Clinchfield Sand & Feldspar Corp., 618 Mercantile Trust Bldg., Baltimore, Md.
Merck & Co., Inc., Rahway, N. J.
American Cynamid & Chemical Corp., 30 Rockefeller Plaza, New York 20, N. Y.

Wire Cloths:

NEW YORK WIRE CLOTH COMPANY, 500 Fifth Ave., New York 18, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.
Spargo Wire Co., 255 E. Railroad St., Rome, N. Y.
Wickwire Bros., Inc., 189 Main St., Cortland, N. Y.
Chase Brass & Copper Co., 1939 Rodney St., Waterbury 91, Cinn.

E. COLLECTION, IDENTIFICATION AND GENERAL LABORATORY, FIELD AND RESEARCH EQUIPMENT AND SUPPLIES:

General:

Cannon Electric Development Co., 3209 Humboldt St., Los Angeles 31, Calif.
Schaar & Co., 754 W. Lexington St., Chicago 7, Ill.
Central Scientific Co., 1700 Irving Park Road, Chicago 13, Ill.
Warren-Knight Co., 136 N. 12th St., Philadelphia 7, Pa.
Standard Scientific Supply Corp., 34 W. Fourth St., New York, N. Y.
New York Scientific Supply Co., 28 W. 30th St., New York 1, N. Y.
Emil Greiner Co., 161 Sixth Ave., New York, N. Y.

Biological Laboratory Supplies:

General Biological Supply House, 761-763 E. 69th Place, Chicago, Ill.
Emil Greiner Co., 161 Sixth Ave., New York, N. Y.
Schaar & Co., 754 W. Lexington St., Chicago 7, Ill.
National Scientific Instrument Co., 119 Chambers St., New York 7, N. Y.
Central Scientific Co., 1700 Irving Park Road, Chicago 13, Ill.
American Instrument Co., 8010 Georgia Ave., Silver Spring, Md.
Eimer & Amend, 635 Greenwich St., New York 14, N. Y.
Clay-Adams Co., 44 E. 23rd St., New York 10, N. Y.
Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Pa.

Chemical Laboratory Supplies:

Emil Greiner Co., 161 Sixth Ave., New York, N. Y.
Eastman Kodak, Rochester 4, N. Y.
Central Scientific Co., 1700 Irving Park Road, Chicago 13, Ill.
Eimer & Amend, 635 Greenwich St., New York 14, N. Y.
Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Pa.
American Instrument Co., 8010 Georgia Ave., Silver Spring, Md.
E. H. Sargent & Co., 155-165 E. Superior St., Chicago 11, Ill.

Collecting, Boxes, Metal, Plastics:

Columbia Steel Tank Co., Kansas City 7, Mo.

Collecting Tubes:

Ward's Natural Science Estab., Inc., P. O. Box 24, Beechwood Station, Rochester. N. Y.

Entomological Supplies:

Clay-Adams Co., 44 E. 23rd St., New York 10, N. Y.
Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Pa.
Ward's Natural Science Estab., Inc., P. O. Box 24, Beechwood Station, Rochester, N. Y.

Forceps:

Ward's Natural Science Estab., Inc., P. O. Box 24, Beechwood Station, Rochester, N. Y.

Hand Lenses:

Eric Sobotka, 15 E. 40th St., New York 16, N. Y.

Hydrometers:

Taylor Instrument Companies, Rochester, N. Y.

Insect Boxes:

Clay-Adams Co., 44 E. 23rd St., New York 10, N. Y.

Insect Pins:

Ward's Natural Science Estab., Inc., P. O. Box 24, Beechwood Station, Rochester, N. Y.

Instruments, Dissecting:

Eimer & Amend, 635 Greenwich St., New York 14, N. Y.
Swift & Anderson, Inc., 109 Sumner S., Boston, Mass.

Laboratory Glassware:

E. H. Sargent & Co., 155-165 E. Superior St., Chicago 11, Ill.
Corning Glass Works, Corning, N. Y.

Magnifiers:

American Optical Co., 1940 Thomas St., Southbridge, Mass.
Eric Sobotka, 15 E. 40th St., New York 16, N. Y.

Microscopes, Binocular and Compound:

E. Leitz, Inc., 730 Fifth Ave., New York 19, N. Y.
American Optical Co., 1940 Thomas St., Southbridge, Mass.
Eric Sobotka, 15 E. 40th St., New York 16, N. Y.
Swift & Anderson, Inc., 109 Sumner St., Boston, Mass.
E. H. Sargent & Co., 155-165 E. Superior St., Chicago 11, Ill.

Microscope Supplies:

American Optical Co., 1940 Thomas St., Southbridge, Mass.

Mosquito Traps:

HAUSHERR'S MACHINE WORKS, Bayville, N. J.

PH Apparatus:

Eric Sobotka, 15 E. 40th St., New York 16, N. Y.
American Instrument Co., 8010 Georgia Ave., Silver Spring, Md.

Thermometers:

Swift & Anderson, Inc., 109 Sumner St., Boston, Mass.
Taylor Instrument Companies, Rochester, N. Y.

F. PHOTOGRAPHIC AND GENERAL EDUCATIONAL EQUIPMENT, SUPPLIES AND SERVICES:

General:

RCA Victor Division of Radio Corporation of America, Camden, N. J.
The Folmer Graflex Corp., Clarissa and Whittaker Sts., Rochester, N. Y.

Cameras, Motion Pictures:

Bell & Howell Co., 7100 McCormick Road, Chicago 45, Ill.

Cameras, Still:

E. Leitz, Inc., 730 Fifth Ave., New York 19, N. Y.
The Folmer Graflex Corp., Clarissa and Whittaker Sts., Rochester, N. Y.

Lantern Slides, Educational:

Clay-Adams Co., 44 E. 23rd St., New York 10, N. Y.

Micro-Film Readers:

Clay-Adams Co., 44 E. 23rd St., New York 10, N. Y.
American Optical Co. 1940 Thomas St., Southbridge, Mass.

Motion Picture Films, Educational:

Bell & Howell Co., 7100 McCormick Road, Chicago 45, Ill.

Motion Picture Films, Mosquito:

Alemeda Co. Mosquito Abatement Dist., Oakland, Calif.
American Film Center, Inc., 45 Rockefeller Plaza, New York, N. Y.
Bray Pictures, Inc., 729 Seventh Ave., New York, N. Y.
Eastman Kodak, Rochester, N. Y.
Essex County Mosquito Extermination Commission, Hall of Records, Newark, N. J.
Edited Pictures System, Inc., 330 W. 42nd St., New York, N. Y.
Iowa State College, Visual Instruction Service, Ames, Iowa.
Nassau County Mosquito Extermination Commission, Rockville Centre, L. I., N. Y.
T. V. A., Health Education and Information Services, Chattanooga, Tenn.
U. S. Dept. of Agriculture, Washington, D. C.
U. S. Public Health Service, Washington, D. C.
University of Utah, Salt Lake City, Utah.

Photographic Supplies:

The Folmer Graflex Corp., Clarissa and Whittaker Sts., Rochester, N. Y.
Clay-Adams Co., 44 E. 23rd St., New York 10, N. Y.
Ansco, Binghamton, N. Y.
Shaw Blue Print Machine Co., 12 E. Park St., Newark 2, N. J.
Eastman Kodak, Rochester 4, N. Y.

Projectors, Lantern Slides:

E. Leitz, Inc., 730 Fifth Ave., New York 19, N. Y.
Eric Sobotka, 15 E. 40th St., New York 16, N. Y.
Clay-Adams Co., 44 E. 23rd St., New York 10, N. Y.
American Optical Co., 1940 Thomas St., Southbridge, Mass.
Bell & Howell Co., 7100 McCormick Road, Chicago 45, Ill.

Projectors, Motion Picture:

Bell & Howell Co., 7100 McCormick Road, Chicago 45, Ill.
Eastman Kodak, Rochester, N. Y.

Projectors, Opaque:

Eric Sobotka, 15 E. 40th St., New York 16, N. Y.
American Optical Co., 1940 Thomas St., Southbridge, Mass.

G. OFFICE EQUIPMENT, SYSTEMS AND SUPPLIES:

Bookcases:

Angle Steel Stool Co., 119 Water St., Plainwell, Mich.

Cases, Filing:

Columbia Steel Tank Co., Kansas City 7, Mo.

Cases, Blue Print Map:

Angle Steel Stool Co., 119 Water St., Plainwell, Mich.

Cases, Wardrobe, Storage:

Browne-Morse Co., Muskegon, Mich.
Angle Steel Stool Co., 119 Water St., Plainwell, Mich.

Duplicating Machines and Supplies:

American Photocopy Equipment Co., 2849 N. Clark St., Chicago 14, Ill.

Filing Equipment:

Browne-Morse Co., Muskegon, Mich.

Laboratory Furniture:

E. H. Sheldon & Co, 149 Thomas St., Muskegon, Mich.

Office Furniture:

Browne-Morse Co., Muskegon, Mich.
Yawman & Erber Mfg. Co., Jay and Gilde Sts., Rochester, N. Y.
Angle Steel Stole Co., 119 Water St., Plainwell, Mich.
Sturgis Posture Chair Co., Marine St., Sturgis, Mich.

Photostat Outfits:

American Photocopy Equipment Co., 2849 N. Clark St., Chicago 14, Ill.

Stapling Machines:

Acme Staple Co., 1700 Hadden Ave., Camden, N. J.

H. BOOKS AND PERIODICALS:

General:

Charles C. Thomas, Publisher, 301-327 E. Lawrence Ave., Springfield, Ill.

Engineering and Technical Periodicals:

Harper & Bros., 49 E. 33rd St., New York 16, N. Y.
Comstock Publishing Co., Inc., Roberts Place, Ithaca, N. Y.

Reference, Dictionaries, etc.:

McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y.
Macmillan Co., 60 Fifth Ave., New York 11, N. Y.

Technical Books:

The Blakiston Co., Philadelphia 5, Pa.
W. B. Saunders Co., Philadelphia 5, Pa.
Macmillan Co., 60 Fifth Ave., New York 11, N. Y.
Commonwealth Fund, 41 E. 57th St., New York 22, N. Y.
Potter & Moore, Lavender House, London, England.
McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y.
University of California Press, Berkeley 4, Calif.
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